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The Right to Buy public housing in Britain: A welfare analysis☆

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ABSTRACT

We investigate the impact on social welfare of the United Kingdom (UK) policy introduced in 1980 by which public housing tenants (council housing in UK parlance) had the right to purchase their houses at heavily discounted prices. This was known as the Right to Buy (RTB) policy. Although this internationally-unique policy was the largest source of public privatization revenue in the UK and raised home ownership as a share of housing tenure by around 15%, the policy has been little analyzed by economists. We investigate the equilibrium housing policy of the public authority in terms of quality and quantity of publicly-provided housing both in the absence and presence of a RTB policy. We find that RTB can improve the aggregate welfare of low-income households only if the council housing quality is sufficiently low such that middle-wealth households have no incentive to exercise RTB. We also explore the welfare effects of various adjustments to the policy, in particular (i) to reduce discounts on RTB sales; (ii) to loosen restrictions on resale; (iii) to return the proceeds from RTB sales to local authorities to construct new public properties; and (iv) to replace RTB with rent subsidies in cash.

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1. Introduction

This paper undertakes what we believe to be the first welfare analysis of the Right to Buy (RTB) policy for publicly-owned housing that was developed in the late 1970s in the United Kingdom (UK) and became a flagship policy of the Thatcher government. RTB allowed tenants in publicly-owned council housing to buy their rented accommodation at a heavily subsidized price (albeit with subsidies that varied both over time and geographically across local jurisdictions). Overall, RTB was largely responsible for an increase in the share of home ownership among householders in the UK from 55% in 1979 to over 70% in the early 2000s, thereby inducing a large-scale change in asset ownership among UK households in a relatively short period. Despite being an innovative and internationally-unique policy, RTB has been little analyzed by economists in Britain and elsewhere.

In the paper we examine the incentives implied by the RTB policy in the context of a model of heterogeneous households choosing between private ownership, private renting, and public renting. We describe the policy background to the provision of public housing in the UK and the development of the RTB policy in the remainder of Section 1. The remaining sections of the paper construct a theoretical argument on RTB which reflects these stylized historical facts, a brief description of which is as follows.

Household heterogeneity arises because households have different prospective life-cycle wealth profiles and, within any period, differing probabilities of high income 'draws'. Given the significant fixed cost of purchasing a house, a household needs sufficient high

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income 'draws' to be in a position to purchase.[1] Moreover, the demand for housing units (in terms of quantity and quality) is increasing in income and wealth. Hence the supply of private housing reflects the financial position and preferences of households with more frequent high income 'draws'. Since, in the long run, private rents must reflect the annuitized price of private housing units, the private rental market also caters for the preferences of the same segment of households (Section 2.1).

The rationale for public sector housing is that it supplies lower quality units of housing that may not be provided by the private sector. These can be rented by households with few high income 'draws', so long as public housing is provided at similar cost-per-unit for given quality to private housing. We show evidence that public housing in the UK is indeed of lower quality but can find no robust evidence of the public cost inefficiencies frequently described in the literature in the United States. Indeed, since local authorities are budget-constrained, constructing higher quality units would lead to greater demand for public housing and hence rationing (queueing). We derive an equilibrium quality of public housing which reflects this trade-off (Section 2.2).

The 'Right to Buy' (RTB) policy, by subsidizing purchase price and reducing fixed costs of purchase (e.g. by allowing higher loan-to-value ratios and cheaper credit terms), allows households with fewer high income 'draws' to purchase their public housing. But not every household which is eligible for RTB will necessarily purchase because public housing rents are subsidized and maintenance costs are generally borne by the public authority. A household considering RTB will trade-off these costs against their preference (if any) for home ownership over renting. Over time, two key effects of the RTB policy are to reduce the stock of public housing relative to private housing, but also to change the distribution of 'quality' of housing units within the private sector (Section 3). In Section 3.1 we provide some new empirical evidence on the distribution of housing units and also on the characteristics of council tenants and of those who opt to purchase their public housing under the ''Right to Buy' policy.

In Section 4, we examine various reforms to the RTB program, including changing the discount rate on RTB sales (Section 4.1), loosening resale restrictions on housing purchased through RTB (Section 4.2), permitting local public authorities to retain receipts from RTB sales in order to construct new public housing of a particular quality (Section 4.3), and finally, replacing public housing with cash subsidies (Section 4.4). Section 5 provides a brief conclusion to the paper.[2]

1.1. Background: council housing and the development of Right to Buy

'Council housing' (the term for public housing constructed by local government authorities in the UK) was a policy developed from the early 1920s onwards in order to re-house low income families in subsidized, rented, accommodation. The need to re-house families arose from an ongoing policy of slum clearance in the 1920s and 1930s coupled with a perceived shortage of affordable private rented housing; a need heightened from the 1940s onwards because 4 million houses in the UK were seriously damaged or destroyed by bombing between 1939 and 1945. Aided by the 1946 Land Acquisitions Act, which allowed local authorities to acquire land for construction, and by direct subsidies from central government, council house construction accelerated after 1945 and continued well into the 1970s. By 1979 around 32% of dwellings in Britain were council houses, totalling some 6.5 million properties – a far greater share of the total housing stock than that of public housing in, for example, the United States.[3]

It is reasonable to ask – at least from a North American viewpoint – why increased provision of public housing, rather than encouragement of private ownership and construction, played such a dominant role in UK housing policy for such a long period. But it should be remembered that the UK, over the century beginning in the late 1910s, moved from a nation of private renters to one of private owners as well as public renters. Chart 1 shows how, between 1918 and 1991, the share of private renting fell from 76% of housing tenures to only 9% of housing tenures. And Chart 2 shows that, although there were periods in which public housing construction matched or indeed exceeded private construction (such as the decade after 1945), in other periods – notably the 1930s and 1960s - private construction for homeowners dominated public construction by local public authorities. The important role of public construction (at least, relative to North America) seems to have stemmed from several factors: borrowing constraints both on the one hand on private builders and landlords seeking to renovate properties in the 1920s but also on working class tenants seeking to buy their own houses; a shortage of private land and a high degree of public regulation of planned private housebuilding through much of the 1940s and early 1950s; the ideology of 'municipal socialism' which reappeared in the UK at regular intervals between the 1880s and 1940s; and (given the large share of public housing) the apparent absence of the stigma and social externalities associated with public housing in the United States. Nevertheless, it is perhaps surprising to housing economists that, even in the late 1950s, the number of housing units constructed for local public authorities still exceeded the number of private dwellings constructed in the UK.

Because of the capacity of public authorities to construct relatively cheap lower quality housing units, council housing in the UK has been generally regarded as a solution to the major social problem of a shortage of affordable housing. Council housing is normally allocated to families by a simple queueing mechanism with priority given to families with special housing needs (homelessness, state of existing accommodation, severe health problems, eviction unrelated to personal behavior, etc.) but also more generally to those with low incomes and/or proxies for low income such as family size and employment status (or lack of it). For those without priority needs, waiting times could be as long as several years or indeed indefinite, although in the heyday of council housing a local authority could usually offer a property of some kind within a shorter period. For tenants, the attractiveness of council housing is that rents are usually significantly lower than those for equivalent private sector rental properties, and indeed private rentals had become increasingly scarce by the end of the 1970s. Maintenance costs of council housing are in general covered by local authorities. These implicit subsidies were in part made possible by direct subsidies for construction from central government (including allowing local authorities to borrow at lower interest rates than private housebuilders) and by the development of low-cost system construction methods which, however, subsequently some-

[1] We do not explicitly discuss the argument that individuals with more income volatility, for given expected wealth, would prefer to rent rather than buy (Ioannides, 1979; Rosen et al., 1984) - a result which finds some empirical support in Robst et al. (1999). Among a number of subsequent contributions, Ortalo-Magne and Rady (2002) argue that the standard result hinges on the nature of the covariance between income and asset price volatility.

[2] Although we discuss the redistributional implications of the RTB program, we do not explicitly examine public housing policy as an additional instrument for redistribution, providing in-kind rather than cash transfers, other than our brief discussion in Section 4.4. This argument for public housing is highly controversial in the United States though it provides an additional rationale for the development of public housing in the UK, at least until the 1950s. For further discussion in the context of housing, see Aaron and Von Furstenberg (1971); Thurow (1984) and Bruce and Waldman (1991).

[3] Jones and Murie (2006) Table 2.2. and p.52.

times led to higher maintenance costs falling on the local authorities.

However, the policy also had obvious costs, which became more apparent over time and especially in the late 1950s. Rents were subsidized but did not cover the full economic cost, hence local authorities bore a burden that was only partly subsidized by block grants from central authorities. Excess demand for council housing prevailed. Families who got on a council house waiting list had no incentive to remove themselves from that list; indeed, even if a family's economic conditions improved, there was no incentive to exit the council house sector at all. This, it was suggested, reduced the flexibility of the labor market (e.g. Hughes and McCormick, 1981). As the criteria for council house priority shifted from slum clearance and rehousing to family 'need', there were strong incentives for families to assume the characteristics (lack of job, large number of children, partnership dissolution) that increased eligibility. Finally, there was a belated recognition that a socially-optimal housing policy might move away from a distortion of demand towards public renting in favor of an increase in private provision – both in the form of private ownership and private renting. These had, to a large extent, been constrained by a mixture of borrowing constraints (both on would-be purchasers and housebuilders), rent controls, planning regulations, and ideological perceptions.

Hence, as real incomes increased, the need for constructing further council houses seemed less clear-cut. Although significant council-house construction continued into the late 1970s, the program peaked in the early 1950s. A succession of Conservative governments began to emphasize home ownership as a means of distributing wealth more widely. Mortgage interest relief was introduced in 1969 (ironically, by a Labour government). Some local Conservative councils began to see their council housing stock both as a burden on local property taxpayers (subsidized rents and maintenance costs) but also as a potential means of widening asset ownership in their local communities with the potential for externalities arising from a better social mix of residents. There was strong pressure on national government from these local authorities to permit a policy of subsidized selling of the existing council housing stock (albeit with equal resistance from some parts of the Labour Party and from the architects of post-war housing policy). It was the arrival of the Conservative central government under Margaret Thatcher in 1979 with a large parliamentary majority, however, that provided the key impetus for a national RTB policy.

1.2. Evolution of Right to Buy

The Housing Act of 1980 introduced a statutory Right to Buy (RTB) for council tenants with at least three years' tenure in their council houses – 'statutory' in the sense that the policy should be implemented by all local authorities instead of voluntarily by a few Conservative councils. Discounts on the sale price relative to the assessed market value of a property ranged from 33% for council tenants with three years' residence through to a maximum of 50% after twenty years' residence. Local authorities were also required to make mortgages available to would-be purchasers albeit subject to standard age limits and income multiples. The discount would be repayable if the property was sold within five years of a RTB purchase and there was a floor price such that recently constructed properties should not be sold at less than the cost of construction. Subsequent legislation in the 1980s relaxed the conditions still further – for example by increasing the discounts for would-be purchasers of apartments and relaxing the cost floor condition.

Chart 3 shows clear peaks in council-house sales arising from the 1980 Act and the liberalization of eligibility conditions and increased discounts in the mid-1980s. New council-house construction almost disappeared after the introduction of RTB although construction of other forms of social (i.e. not-for-profit) housing (around 20,000 new units a year) continued. Although sales were at a lower level after these spikes associated with policy changes and the general decumulation of the council housing stock (especially the better quality housing), sales continued into the mid-2000s at a significant level for two reasons. First, new tenants became eligible by attaining residency requirements and took advantage of low mortgage rates through much of the period. Second, residual opposition from some Labour councils impeded the process and speed of sales in some localities, for example by evading statutory requirements by handing their housing stock over to social housing association where conditions for sale were considerably stricter until these too were liberalized in the early 2000s – hence the further upsurge in sales in the mid-2000s.

By the mid-2000s, around 2.8 million council houses had been sold in the UK, mostly under RTB. These sales comprised around half the total stock that had existing at the start of the policy (Jones and Murie, 2006). Who were the gainers and losers from the policy?

There were two clear groups of winners from the policy. The first group were obviously ex-council tenants who had been able to purchase relatively desirable properties at heavily discounted prices. By exercising RTB, however, they became responsible for their mortgage finance and for the maintenance and upkeep of their properties; moreover, the resale restrictions mean that, if a purchaser was no longer in a position to pay off the mortgage, he or she was at risk of foreclosure. As we will discuss shortly, this is a nontrivial potential cost given the likelihood that many ex-council tenants had relatively low incomes.

The second group of gainers from the RTB policy were taxpayers in general, via central government, because the bulk of receipts from council-house sales was offset by a reduction in central grants to local authorities - that is, receipts were mostly effectively transferred to the central government. After 1990, local authorities normally had access to only 25% of the capital receipts with the remaining 75% treated as 'reserved receipts' which could not be utilized for replacement of the council housing stock. Indeed, even the retained 25% of receipts could be used for maintenance and renovation of the existing stock rather than construction of new council houses. The sales of council houses were the 'largest privatization' undertaken in the UK in this period in terms of raising revenue for the central government, exceeding the proceeds from sales of any other major public utilities in the same period (House of Commons, 1999, p.11).

There were two groups of potential losers from the policy. First were local authorities. Although the RTB program reduced the need of covering maintenance costs and subsidizing rents, local authorities had received little of the receipts from sales and still had a statutory duty to rehouse the homeless and those with pressing housing needs. Malpass and Murie (1999) point out that subsidies paid by local authorities to cover council tenants had fallen in nominal terms from £2.1 billion in 1980 to £1.2 billion in 1990 – a clear saving to local authorities. However, as these authors state, the number of applicants for council housing arising from homelessness more than doubled over the same period, from 63,000 to 146,000. This partly reflected the continued decline of the private rental market over the longer period (see Chart 1). By being forced to house homeless families in unsuitable or more expensive housing (e.g. private tenancies or even hotels), the savings to local authorities from lower maintenance costs and subsidized rentals arising from RTB were steadily eroded over time as the stock of rental properties – both public and private – shrank.

The second potential group of losers were subsequent generations of would-be council tenants who, not being priority claimants, and in the face of a shrinking stock of council houses, faced longer and possibly indefinite waiting times. This argument, commonly made by commentators in the UK, should be treated

with some caution because during the same period, expenditure on a benefit specifically earmarked for housing support for low-income families – Housing Benefit – expended rapidly. Tenants with low incomes and limited assets could receive Housing Benefit as a contribution towards private or indeed social housing rents. The difficulty for would-be tenants therefore arises primarily from the shrinking of the rental sector *as a whole* in this period. Only insofar as council houses had different characteristics (for example, in terms of quality) and therefore involved lower outlays on housing net of subsidy, would the shortage of council houses *per se* affect welfare. Differences in average quality between publicly and privately constructed housing are an important component of the model that we develop in subsequent sections.

There are two other groups to consider. First, there were residual council tenants who chose not to (or were not in a financial position to) exercise RTB. Inevitably 'cherry-picking' of better properties by better-off tenants increased the likelihood of the public housing stock becoming over time a residual of the lowest quality housing inhabited by the lowest income group – a process of 'ghettoization' at odds with the ideals of some founders of 'garden city' public housing constructed for the working poor in the 1930s. The second group were would-be homeowners. Although each RTB purchase transferred a property from the rented to the owned housing sector, initially a RTB property came with an owner who was restricted in his or her capacity to resell the property by the statutory limitations on resale. Over time, however, such properties would come on the resale market due to moves into private rental, upscaling to better quality houses, foreclosure, deaths, or changes in family composition. If council properties were significantly different from privately-constructed properties (for example, of lower quality and therefore cheaper), this would change the distribution of available types of properties in the private market, for example providing access to cheaper properties for private tenants aspiring to be first-time buyers. Hence the RTB policy had implications for equilibrium in the market for home-ownership as well as the rental market.

Finally, some developments of the RTB policy in later years should be mentioned. On the one hand, the Labour government that came to power in 1997 decided to tighten up the rules for selling council houses. A series of measures between 1998 and 2004 tightened eligibility conditions, limited access to publicly-provided mortgages, extended and restricted conditions on resale and capped discounts in areas of greatest council housing shortages such as London (for details, see Jones and Murie, 2006; House of Commons, 2012). For example, in 2003, the maximum absolute discount on a council property for RTB in all but two London boroughs was reduced to £16,000. Since London is the area of the highest house prices and rents, this reduced the RTB incentive to a fraction of that available during the 1980s. Subsequently, for similar reasons, the national government in Scotland ceased council-house sales altogether. On the other hand, as we have already mentioned, the Labour government allowed a relaxation of the restrictions on the purchase of properties held by social housing associations under the provisions of 'Right to Acquire'.

This is not quite the end of the story of the UK RTB policy. In 2012 the new Coalition government between the Conservatives and the Liberal Democrats announced that they wished to 'reinvigorate' the RTB policy. The central policy proposal, subsequently implemented, was to raise the maximum discount to £75,000 across all local authorities irrespective of local housing prices outside London, and indeed to £100,000 within London. The government also proposed that local authorities might be able to retain a greater fraction of the proceeds from council-house sales as long as the proceeds were used to construct replacement affordable (i.e. relatively low quality) housing units. As Charts 2 and 3 suggest, there is some evidence that the latest policy has increased the rate of council-house sales but as yet little evidence of an upturn in construction of council housing.

2. A model of housing tenure

In this section, we consider a model of housing tenure in the absence of Right to Buy but with the presence of a public housing sector. We first describe the setting, as one of heterogeneous households facing different income processes. This heterogeneity of income profiles plays a key role in the allocation of households across tenure types. We follow this with a simple model of equilibrium in the private housing market, in terms of the choice between owning and renting properties, and the implications thereof for housing prices and rents. We then extend the model to include a public housing sector.

To examine this choice of housing tenure, we consider a discrete-time economy with two goods: a nondurable good (for example, food) and a durable good – housing. We suppose that the nondurable good is non-storable, hence it is produced and consumed within each period. In contrast, the durable good, housing, is storable but requires maintenance costs after usage. These costs equal a fraction of the end-of-period housing value and are borne by the owner – whether the private homeowner or the private or public landlord. We abstract from capital gains on privately-owned housing.

There are different types of houses – for example by size, quality of construction, amenity value, etc., in both the public and private sectors. Given this menu of choices, houses in the private sector are broadly allocated by factors such as household composition and household income. Public housing is also heterogeneous and will typically be matched to eligible households of given composition by an administrative formula (e.g. relating number of rooms to size of family).

It has been well-documented in the United States that public production of public housing is cost-inefficient relative to private construction (see, for example, Schill, 1993 and Olsen, 2003). We have found no evidence that UK public housing on average has been more costly to construct or maintain than private housing, although the lack of a cost differential may arise from the scarcity of land for private development and planning restrictions in the United Kingdom which have forced up the price of land and hence the cost of new private housing. On the other hand, it *has* been documented that UK public housing is on average of lower quality than equivalent private houses by type (e.g. number of bedrooms) in the sense of floor space per person, amenities, etc. (Forrest and Murie, 1990). This is also reflected in the price of council housing sold under the RTB policy where a discount of 20% on resold RTB dwellings relative to similar privately-constructed housing types is typical (Jones and Murie, 1999; 2006).[4] Hence, we assume that the possible range of public housing quality is between zero and one, with the quality of any type of public housing at best equal to the equivalent privately-owned house which is normalized to one and at worse of some positive quality close to zero. We also assume that the demand for housing 'quality' is increasing in household income and wealth, which will be incorporated into the general form of household utility that is increasing in consumption and housing. However, we do not assume that the costs of public and private construction, quality-adjusted, differ across sectors.[5]

[4] As mentioned in the previous section, dwellings under RTB are not a random sample of local authority dwellings. The RTB policy allows 'cherry-picking' of the more attractive local authority-owned properties.

[5] The assumption is not needed for the subsequent argument, so long as the public sector is not significantly less efficient than the private sector in terms of cost of construction.

We now briefly sketch out the basic model of households' choice of tenure and pricing of owned and rented houses in the private sector. We need to do this because, as we shall consider in due course, council tenants who exercise RTB may then have the option to resell their purchased council houses and rent in the private sector.

2.1. Households' choice of private-housing tenure

Consider a simple economy where households are heterogeneous in their current income and expected future incomes. In any period, there are two possible outcomes of household income: a 'Low' income Y^L and a 'High' income Y^H. The income process is risky. Households also differ in their lifetime wealth arising from their cumulated incomes, which is characterized by their ability to obtain the high income in any period, defined as λ^i, where $\lambda^i \in (0, 1)$ for any household i. For expositional purposes we discretize the distribution of households into three wealth categories: 'high' wealth households who almost always receive 'high' income draws, 'middle' wealth households who have a relatively high probability of receiving the high income but whose income process is more volatile (such as self-employed or skilled manual workers), and 'low' wealth households who almost always receive 'low' income draws. Denote these three types of households as, respectively, λ^h (where λ^h is close to one), λ^m (where λ^m is within a region of 0.5), and λ^l (where λ^l is close to zero) households. Assume that the measure of each type of households, N^i, $i \in \{h, m, l\}$, remains fixed over time. Since the primary focus of this paper is on the decision to exercise the RTB option on public housing, we will mostly abstract from high-wealth households with consistent draws of Y^H for two reasons: first, they tend to own rather than rent (see below), and second, they are ineligible to apply for council housing.

Our model proceeds as follows. Households generate utility from non-durable consumption and from durable housing. For simplicity, we assume no borrowing other than mortgages and no saving other than the repayment of mortgages. In general form, the utility of a household is a strictly increasing and concave function of consumption, housing and of whether the household is an owner-occupier or tenant:

$$u(C_{jt}, H_{jt}, \psi_{jt}), \tag{1}$$

where C_{jt} is household j's consumption, H_{jt} is its consumption of housing 'units', and ψ_{jt} is the indicator function of whether household j is a homeowner ($\psi_t = 1$) or a tenant ($\psi_t = 0$). Housing 'units' can be thought of as having both a quantity dimension (e.g. number of rooms) and a quality dimension (e.g. size of rooms, quality of fittings). Both consumption and housing are normal goods hence demand for either increases with income and wealth. Our assumption that households like quality implies that the cross derivative of utility is positive: $u_{CH} > 0$. We also assume, as in other models such as Kiyotaki et al. (2011) that households, other things being equal, obtain greater utility from owning than renting, since home ownership allows the household greater freedom in terms of home improvement, interior decoration, etc. Higher levels of housing consumption increase the utility of homeowners more than tenants. This also implies that the utility increment, in terms of housing quality, associated with shifting from renting to home ownership exceeds the increment in the utility of consumption: $u_H(C, H, 1) - u_H(C, H, 0) > u_C(C, H, 1) - u_C(C, H, 0)$.

Costs of housing are determined as follows. Let P be the price of a quality-adjusted housing unit. We assume that there is a maintenance cost per unit of housing, δ, which is borne by the homeowner whether he or she lives in or rents out the property. Households who choose to purchase houses finance their home ownership through mortgages provided by a private financial institution. Mortgages are paid at the end of each period, amortized to infinity and incur an interest charge r. We assume that there is a fixed adjustment cost or utility decrement FC of purchasing a housing unit. This fixed cost is proportional to the quality of the unit of housing and includes agency fees, house insurance, taxes on house purchase, and the opportunity cost of any down payment on the mortgage. Having paid the fixed cost to purchase a house, a homeowner pays the mortgage plus the maintenance cost of the house in each period i.e. $(r + \delta)P$.

We now make a key assumption. We assume that high-wealth households receive enough high income 'draws' to overcome the fixed cost component of purchase (and given that the demand for housing quality is increasing in income and wealth). However, middle- and low-wealth households do not receive enough high income 'draws' for the fixed cost hurdle to be overcome.[6] Middle-wealth households, who prefer higher quality than low-wealth households, can rent privately but cannot buy homes. Given this sorting among households, private housebuilders only construct high-quality homes to satisfy the housing need of high-wealth households and middle-wealth households (as renters).

The private rental market functions such that the average rent equals the amortized value of a house. Then the per unit housing rent is $R = (r + \delta)P$, and the equilibrium rent of a house constructed by private housebuilders maximizes the utility of a high-income tenant. Hence the private housing rent equals a high-income tenant's marginal rate of substitution of housing for consumption, which measures how many units of consumption goods that the tenant would like to give up for one additional unit of housing. Normalizing the quality of the house that a high-income tenant decides to rent to one, the equilibrium private housing rent is determined in Eq. (2) as follows.

$$R = \frac{u_H(Y^H - R, 1, 0)}{u_C(Y^H - R, 1, 0)}, \tag{2}$$

where rents are hedonically related to housing characteristics.

At equilibrium, the value function, $V^i(Y_{jt}, H_{jt}, \psi_{jt})$, of a high-, middle-, or low-wealth ($i \in \{h, m, l\}$) household who receives the high or low income ($Y_{jt} = \{Y^H, Y^L\}$) and lives in an owned or rented house ($\psi_{jt} = \{1, 0\}$) of quality H_{jt} satisfies:

$$\begin{aligned} rV^i(Y_{jt}, H_{jt}, \psi_{jt}) = \; & -rFC \cdot H_{jt}\psi_{jt} + \frac{r}{1+r}u(Y_{jt} - RH_{jt}, H_{jt}, \psi_{jt}) \\ & + \frac{\lambda^i}{1+r}u(Y^H - RH_{jt}, H_{jt}, \psi_{jt}) \\ & + \frac{1-\lambda^i}{1+r}u(Y^L - RH_{jt}, H_{jt}, \psi_{jt}). \end{aligned} \tag{3}$$

The value of owning a private house, $V^i(Y_{jt}, H_{jt}, 1)$, equals the current utility of living in one's own house plus the future value of owner-occupation whether receiving the high or low income, minus the fixed cost of purchasing the house. In contrast, the value of renting a private house, $V^i(Y_{jt}, H_{jt}, 0)$, equals the lifetime value of renting a private housing whether receiving the high or low income.

Tenure choice between owning and renting depends on two factors: the probability that a household has a high income 'draw' i.e. λ^i ($i \in \{h, m, l\}$) and the fixed adjustment cost (decrement of utility) associated with purchasing a house. We can formulate our assumptions as follows.

Assumption 1. Assume that the fixed cost of owning a house is large such that after paying the amortized fixed cost, only high-income but not low-income homeowners generate higher utility living in

[6] We could also realistically assume that low income households facing a borrowing constraint but a fixed cost component to house purchase is sufficient for our model.

owned relative to rented private housing, that is:

$$u(Y^L - R, 1, 1) - u(Y^L - R, 1, 0) < rFC < u(Y^H - R, 1, 1) - u(Y^H - R, 1, 0), \quad (4)$$

even though owning a high quality private house increases low-income households' utility by a larger amount than the fixed adjustment cost of owning the house, that is:

$$-Ru_C(Y^L - R, 1, 1) + u_H(Y^L - R, 1, 1) > rFC. \quad (5)$$

Assume also that $\lambda^h > \bar{\lambda} > \lambda^m$ (and hence $\lambda^l < \bar{\lambda}$), where $\bar{\lambda}$ is the 'break even' probability of receiving the high income at which a household is just indifferent between owning and renting a private house:

$$\bar{\lambda} = \frac{-\left(u(Y^L-R,1,1)-u(Y^L-R,1,0)-rFC\right)-r\left(u(Y^H-R,1,1)-u(Y^H-R,1,0)-rFC\right)}{-\left(u(Y^L-R,1,1)-u(Y^L-R,1,0)\right)+\left(u(Y^H-R,1,1)-u(Y^H-R,1,0)\right)}. \quad (6)$$

This has two implications. First, the stock of private housing, whether owner-occupied, or rented out by landlords, reflects the quality choices of those with sufficient high income 'draws' (since landlords must also have purchased their properties). Second, high-wealth households can either rent or buy privately but middle-wealth households can only rent privately given the fixed cost constraint. Low-wealth households would prefer lower quality housing and, without government transfers, may be homeless.

2.2. Council housing

We now extend the model to an additional form of tenure: public ('council') housing. We make two reasonable assumptions. First, we assume that at the time that most of the council house stock was constructed, there was no expectation that a Right-to-Buy policy would later be introduced. Second, we assume that the local authority wishes to maximize the utility of low-wealth tenants, although there will inevitably be some middle-wealth tenants with low income outcomes who apply for and obtain council houses. We therefore consider a 'steady state' in which the quality of newly constructed council houses remains the same as does the budget of local authorities.[7] We then consider the council house sector in three stages: first, the budget constraint facing local authorities; second, the choice by local authorities as to what quality of council house to construct and how to allocate them among applicants and third, the ensuing choices facing households.

To apply for public (council) housing, an applicant must have a current low income Y^L. We assume that this income draw is observable to the local public authority; however the cumulated process of income draws ('wealth') is private information to the household. The overt criteria that local authorities use for allocating public housing vary but are usually based on a set of criteria that proxy current low incomes (for example, family size relative to income, affordability of private accommodation etc.). There is generally not an explicit wealth test applied to applicants for council housing.

The supply of council houses is determined as follows: local authorities borrow money up to a given constraint from central government in order to construct houses. Define the total budget constraint of the local authority in any period as B, and the interest rate as r – we abstract for simplicity from any difference in mortgage rates faced by households and the borrowing costs of local authorities. In cash flow terms, local authorities receive rents from council tenants, possibly supplemented by other central government transfers, pay interest on loans borrowed to construct housing and pay for maintenance of their existing public housing stock. The amortized cost of constructing and maintaining a new council house of given quality η is $R\eta$, where $\eta \leq 1$ and the average quality of a privately owned house is normalized to one. Define T as the rent subsidy per period to a council tenant, where $T \geq 0$ and the rent subsidy is defined as the reduction in rent below the private sector rental on a house of equivalent quality; hence council tenants pay rent of $R\eta - T$ to the local authority in each period.[8]

Since the cost of constructing houses and the budget constraint are exogenous, the only variables available to local authorities are the average rent subsidy, T, and the average quality of council houses, η – that is, the local authority can spread its budget more thinly by constructing lower quality housing – in the form of, for example, apartments rather than houses, lower floor space per room, lower quality decoration, confined size of gardens or yards etc. The demand for council houses will depend positively on the average quality of the stock of houses. Of course, this average quality of council housing is constrained insofar as it cannot be so low that no one wishes to rent a council house or, on the other hand, so high that it exceeds the effective budget constraint.

In this setting, the local authority solves a problem that determines the average quality of council houses, the stock of applicants for council houses and (in due course) the likelihood that existing tenants will wish to exercise RTB. Assume that the local authority has a priority ordering among would be council-house applicants, and that the local authority's key observable of 'need' is current income. The council house rental system comprises two components: existing tenancies and a waiting list. The local authority can verify that an applicant joining the waiting list for a council house has a low income. We have already assumed that a household with a high income is not eligible for a council house, that lifetime permanent income or wealth is private information to the household (and that there is no wealth test for council house eligibility[9]), and that existing council tenants are not regularly income-tested. Therefore, from our assumptions in Section 2.1, applicants for council houses will be comprised of those with persistent low incomes (who we defined as 'low wealth') and a fraction of those with volatile incomes (who we defined as 'middle wealth'). The lower the quality of houses that the local authority chooses to construct, the shorter the waiting list for two reasons: first, there are more council houses, and second, given that the demand for quality is increasing in income, lower quality will deter some middle-wealth applicants.

The local authority has a choice over two variables: T and η. The subsidy on rents, T, is effectively constrained by the cash flow of the local authority since the rent collected must be sufficient to cover maintenance plus interest payments on previously-constructed council houses less any additional grants from the central government. Hence, the average rent subsidy per council house equals the per household central government grants or subsidies to local authority current housing budgets.

[7] In reality, evidence suggests that the quality of new builds declined over time, as we shall demonstrate empirically later in the paper. This may reflect both tightened financial constraints of local authorities by central government, but also the changing nature of council house applicants themselves as real incomes rose over time, given the relationship between income level and the demand for quality in housing.

[8] The effective discount below market rents payable by council tenants has varied over time. Generally, attempts to raise council rents towards market levels have shifted the burden of the subsidy away from local authorities towards central government, since higher council rents generally increase eligibility by tenants for Housing Benefit – the means-tested support for housing costs provided by central government. We do not consider this interesting question of incidence further in this paper.

[9] Applicants for council housing cannot already own a property. Other asset tests are not generally mentioned in local authority published criteria for eligibility for council housing. As mentioned, asset tests are applied to applications for Housing Benefit, administered by local government on behalf of central government, but this is a separate issue.

The choice in quality dimension is more interesting, insofar as there is a trade-off for local authorities. If the budget is sufficiently large, the local authority can construct enough low quality housing units to satisfy current demand with the intention of eliminating the waiting list (partly by deterring some applicants). Then the optimal quality of council housing, $\eta^\star$, maximizes the low-income households' utility of renting council houses, which in turn solves:

$$R = \frac{u_H(Y^L - R\eta^\star + T, \eta^\star, 0)}{u_C(Y^L - R\eta^\star + T, \eta^\star, 0)}. \tag{7}$$

Thus, at equilibrium, it is optimal for the local authorities to provide rented council housing of this quality, $\eta^\star$, which is lower than private-housing quality, to all low-income households and increase their aggregate utility by $X\Delta W$, where X is the total measure of low-income households in each period either of low wealth or middle wealth and ΔW is the increment of any low-income tenant's value from renting a council house relative to a private house. Thus, $X = (1-\lambda^l)N^l + (1-\lambda^m)N^m$, where N^l (N^m) is defined as the measure of low-wealth (middle-wealth) households assumed fixed over time. Further, renting a council house relative to a private one increases the utility of a low-income tenant by $r\Delta W$, where:

$$r\Delta W = u(Y^L - R\eta^\star + T, \eta^\star, 0) - u(Y^L - R, 1, 0). \tag{8}$$

Alternatively, the local authority can construct fewer units of higher quality within its budget constraint. This will increase the waiting list but, because the income can be validated during the application process, it can use a queueing system to eliminate some applicants. Households may have several income realizations before they reach the top of the waiting list and some of those with volatile incomes may be sifted out by requiring high-income households to leave the queue. However, a certain fraction of those with volatile incomes may wish subsequently to reapply to the waiting list in order to obtain council housing, insofar as risk aversion and subsidized rentals lead them to prefer council house tenancy to either private ownership or private renting.

3. A model of Right to Buy with no resale

In this section we examine the impact on the welfare of low income households of introducing the Right to Buy council houses at a value that is discounted relative to the market price. Once a household has purchased a council house through the RTB scheme, it is not subject to any income test, but referring back to the discussion in Section 1.1, the current UK policy allows unrestricted sale of a RTB house in the open market only after a certain period, otherwise any monetary discount on the RTB sale must be returned to the local authority. At this point we consider a 'restricted' RTB policy in which the purchaser has to return any monetary discount on the RTB sale to the local authority when reselling the property in the open market at any time. Among the RTB reforms investigated in the next section, a 'less restrictive' policy takes the form of either imposing a duration of ownership after which an open market sale could take place, or varying the discount formula such that a fraction instead of all of the discount is returned irrespective on when the open market resale takes place. As we shall demonstrate in due course, the impact of such restrictions depends crucially on the quality of council houses that are sold relative to the existing private stock.

Following the discussion in the previous section, a local authority provides council housing of quality $\eta^\star$, which solves the equilibrium condition stated in (7), to all low-income households of measure X and equally distributes the grant on the housing budget from the central government among council tenants as a rent subsidy, T. We wish to investigate the welfare gains to council tenants from exercising RTB, if eligible. Clearly the potential gains to exercising RTB will vary across such households according to their preferences, income and wealth, quality of their council properties and so on.

Low-wealth council tenants have a higher probability of remaining in poverty than middle-wealth tenants. But low-wealth tenants have a higher value of exercising RTB than middle-wealth tenants, as we shall explain shortly. The local authority's stock of council houses decreases more rapidly when both low- and middle-wealth tenants are interested in exercising RTB. At equilibrium, for a middle-wealth ($i = m$) or low-wealth ($i = l$) low-income council tenant, his or her value of exercising RTB, V^i_{RTB}, equals the lifetime utility of living in the RTB house when receiving the low income and the maximum of either living in the house or renting a private house but enjoying the benefit from renting out the RTB house when receiving the high income, less the fixed cost of purchasing a house. The value function of not exercising RTB and hence staying as a tenant, V^i_T, equals the lifetime value of renting a council house if the household is allocated one otherwise renting a private house when receiving the low income plus the value of renting a private house when receiving the high income. That is:

$$\begin{aligned} rV^i_{RTB} = & -rFC\eta + \left(1 - \frac{\lambda^i}{1+r}\right) u(Y^L - R\eta^\star + T, \eta^\star, 1) \\ & + \frac{\lambda^i}{1+r} \max\left\{u(Y^H - R\eta^\star + T, \eta^\star, 1), u(Y^H - R + T, 1, 0)\right\}; \\ rV^i_T = & \left(1 - \frac{\lambda^i}{1+r}\right)\left(\gamma u(Y^L - R\eta^\star + T, \eta^\star, 0) + (1-\gamma)u(Y^L - R, 1, 0)\right) \\ & + \frac{\lambda^i}{1+r} u(Y^H - R, 1, 0), \end{aligned} \tag{9}$$

where γ is the equilibrium probability of obtaining a council house when receiving the low income, hence $1-\gamma$ is the probability of not receiving a council house to rent when receiving a low income among both middle- and low-wealth households.

Whether council tenants are interested in exercising RTB depends on both the quality of their council houses and their wealth status – low- or middle-wealth. When the quality of a council house is high (i.e. close to that in the private sector), a RTB purchase is attractive because the benefit of owning a RTB house in low income periods outweighs the foregone opportunity of renting a private house in high-income periods. Then both middle- and low-wealth council tenants are interested in purchasing council houses through the RTB policy. However, when the average quality of council housing is significantly below that of the private sector, only low-wealth council tenants are interested in purchasing their rented council houses by exercising RTB in order to live in them thereafter. Of course, if the quality of council houses is extremely low, no council tenant will wish to purchase their property through RTB. Also, as we shall show in a subsequent section, the 'no resale' constraint is only binding when the quality of the council house is sufficiently low that the tenant does not wish to live in it after purchase.

The intuition of (9) is as follows. When exercising RTB, a council tenant pays the fixed cost of home ownership in utility proportional to the quality of the RTB house. The RTB purchaser can live in or rent out the house but is excluded from future council housing provided by the local authorities. Any monetary discount on a RTB sale has to be returned to the local authority in a resale; and since the fixed cost of home ownership is large, as defined in Assumption 1, exercising RTB in order to resell the RTB house is suboptimal. Therefore, middle-wealth RTB purchasers prefer living in rented high-quality private houses to living in low-quality houses hence rent out their RTB properties to low-income tenants. When not exercising RTB, either middle- or low-wealth tenants receive

council housing with probability γ in low-income periods. They have to rent private houses when they are unable to obtain council housing, which happens in any high-income period and with probability $1-\gamma$ in a low-income period.

At equilibrium, the residual council house stock as the RTB policy evolves is composed of low quality housing that council tenants do not wish to buy. Hence the policy has a natural life span as the average quality decreases. This depletion of the stock increases the waiting time for future generations of would-be council tenants. However, the decision to exercise RTB by an existing tenant should also be based on an expectation of the probability of obtaining a council house in the future. If the proceeds from RTB sales are not available to local councils to construct replacement homes, a paradox of the RTB policy is that it may increase the incentive of an eligible council tenant on the margin to purchase the property, hence reducing the stock still further. RTB purchase acts as a form of insurance by guaranteeing that the purchaser has a property to live in future periods of low income (in periods of high income, he or she can rent out the property and rent a private house of higher quality). In contrast, if the council tenant in periods of high income had simply exited the council house sector and attempted to re-enter during low income periods, he or she would be thwarted by the lengthening queue as the stock was sold off. Hence the expectation of low quantity of council housing in the future drives down the quality threshold at which no council tenant wishes to buy their property through RTB.

Whether RTB increases the aggregate welfare of low-wealth households also depends on the quality of council housing. On one hand, an increase in the average quality of council houses in any particular local authority increases the attractiveness of exercising RTB and hence diminishes the quantity of council housing, both presently (because of the budget constraint issue discussed in the previous section) and in the future (because of the accelerated rate of RTB sales). From a social welfare viewpoint, the utility obtained by council tenants from exercising RTB and owning relatively higher-quality ex-council houses has to be traded-off in welfare terms against the loss of utility to would-be future council tenants for whom public housing is no longer available. In general, any low-income household gains utility from RTB – whether low- or middle-wealth – when the average quality of council housing is higher. On the other hand, the RTB policy is better-targeted on low-wealth households when housing quality is lower for two reasons: first, low-wealth rather than middle-wealth households who exercise RTB disproportionately gain from the policy; secondly, the stock of council housing, other things being equal, is larger and hence the availability of council housing for would-be council tenants in the future is larger.

We wish to analyze the overall implication of the RTB policy on the assumption that the social planner wishes to maximize the welfare of low-wealth households, previously excluded from the private housing market. As we have shown, in practice housing policy towards low-wealth households in the UK is partly determined by the central government (through setting the discount on RTB sales and by allocating housing budgets to local authorities) and partly by local authorities (by their council-house-allocation policies and by the level of rent subsidies to council tenants). From the viewpoint of the social planner, local and central policies should be consistent in the sense that the 'service' provided (in this context, effective housing subsidies to low-wealth households) should be of equal cost. This then allows us to investigate the specific behavioral impact on council tenants of the RTB policy.

Accordingly, we assume initially that the average discount on a RTB sale set by the central authority is equal to the average rent subsidy that a local authority can provide to its remaining tenants through some adjustment of local-authority budgets by the central government. In such circumstances, the equilibrium of the RTB policy and its welfare implications can be summarized in the following proposition (detailed proofs are provided in Appendix 1).

Proposition 1. *RTB houses of quality above η^l attract low-wealth purchasers, of which the diminishing stock is foreseen by middle-wealth council tenants who exercise RTB on houses of quality higher than* $\max\{\eta^l, \eta^m\}$*, where η^l and η^m solve:*

$$\frac{u(Y^H - R\eta^l + T, \eta^l, 1) - u(Y^H - R, 1, 0) - rFC\eta^l}{u(Y^L - R\eta^l + T, \eta^l, 1) - u(Y^L - R\eta^l + T, \eta^l, 0) - rFC\eta^l} = 1 - \frac{1+r}{\lambda^l};$$
$$\frac{u(Y^H - R\eta^m + T, \eta^m, 1) - u(Y^H - R, 1, 0) - rFC\eta^m}{u(Y^L - R\eta^m + T, \eta^m, 1) - u(Y^L - R, 1, 0) - rFC\eta^m} = 1 - \frac{1+r}{\lambda^m}. \quad (10)$$

If council houses are of quality above η^l and below η^m, then exercising RTB can improve the aggregate welfare of low-wealth households – the gains to (largely low-wealth) RTB purchasers outweigh the losses to would-be future council tenants. If council houses are of higher quality than η^m, both middle- and low-wealth households exercise RTB, which lowers the residual supply of council houses for future would-be council tenants. Then the aggregate welfare of low-wealth households decreases since the losses to those who cannot obtain council housing exceed the gains by RTB purchasers, given that many of these are middle-wealth households who are not the priority of the social planner. Conversely, if the average quality of council houses is below η^l, the RTB policy has no effect because no council tenant exercises RTB in such circumstances.

3.1. Some empirical results

In this section, we provide empirical support for some of the theoretical propositions advanced in previous sections. We first examine the characteristics of council house and how these have evolved over time for a representative set of local authorities during the Right-to-Buy period. We show that public (council) housing stocks were highly heterogeneous across housing types among local authorities, reflecting the nature of successive waves of council house construction between the 1920s and the 1960s. Second, we illustrate the process by which RTB sales not only reduced the stock of council houses but also shifted the residual public housing stock towards lower quality housing.

We then look at the characteristics of council tenants, and how these have evolved during the years of the RTB policy. We show that council tenants are poorer than households in the private sector (whether renters or owners) with both a higher unemployment rate and a lower employment rate. They are also more likely to be single, divorced and have more volatile incomes than individuals in private sector tenures. We also show that those who have opted to exercise their RTB typically have higher employment rate and incomes than other council tenants (but lower than those households already in the private sector). Their risk of unemployment is on a par with other private sector tenants and owners rather than residual council tenants by the end of the RTB period.

In relation to housing stocks: by way of background, there are roughly 400 local authorities in England and Wales with average population size of around 120,000 individuals (std dev 100,000). Each local authority has had a degree of autonomy in the council house building polices subject to the central government constraints outlined in Section 1. However, dwellings constructed in the interwar period (1939-45) were predominantly houses, often with several bedrooms, in suburban estates. Later, given the need for rapid post-1945 reconstruction of housing in city centers due to bomb damage, and the changing needs of tenants (as working families were predominantly replaced by the homeless, single parents etc. in the queues for public housing), the focus was on build-

Table 1
Evolution of characteristics of local authority housing: selected authorities.

% of total stock	1 bedroom apartments	2 bedroom apartments	3 bedroom apartments	1 and 2 bedroom houses	3 bedroom houses	Bungalows	4 bedroom dwellings and others	% change in total stock relative to 1980
Name of Local authority								
Hackney (Inner London)								
1980	**0.259**	**0.324**	0.216	0.002	**0.063**	0.000	**0.137**	
1986	**0.342**	**0.300**	0.203	0.007	**0.048**	0.000	**0.100**	0.694
1991	**0.293**	**0.380**	0.216	0.006	**0.046**	0.004	**0.054**	0.603
Barnet (Outer London)								
1980	**0.185**	**0.279**	0.086	0.111	**0.265**	0.008	**0.067**	
1986	**0.200**	**0.293**	0.080	0.123	**0.240**	0.008	**0.056**	−0.034
1991	**0.263**	**0.296**	0.065	0.119	**0.224**	0.013	**0.019**	−0.194
Derby (mid-England)								
1980	**0.111**	**0.066**	0.015	0.140	**0.580**	0.059	**0.028**	
1986	**0.152**	**0.084**	0.017	0.141	**0.506**	0.066	**0.034**	−0.144
1991	**0.176**	**0.094**	0.007	0.141	**0.475**	0.077	**0.030**	−0.269
Wigan (NW England)								
1980	**0.122**	**0.080**	0.029	0.146	**0.522**	0.068	**0.032**	
1986	**0.137**	**0.087**	0.026	0.155	**0.491**	0.085	**0.019**	−0.088
1991	**0.139**	**0.085**	0.005	0.161	**0.495**	0.095	**0.019**	−0.187
Gloucester (SW England)								
1980	**0.190**	**0.133**	0.024	0.047	**0.445**	0.083	**0.080**	
1986	**0.211**	**0.137**	0.024	0.113	**0.365**	0.077	**0.073**	−0.034
1991	**0.228**	**0.149**	0.023	0.112	**0.349**	0.097	**0.043**	−0.093
Newcastle (NE England)								
1980	**0.118**	**0.188**	0.041	0.125	**0.409**	0.045	**0.074**	
1986	**0.129**	**0.202**	0.035	0.134	**0.373**	0.059	**0.069**	−0.078
1991	**0.122**	**0.210**	0.032	0.141	**0.362**	0.065	**0.069**	−0.165
Swansea (W Wales)								
1980	**0.110**	**0.116**	0.022	0.278	**0.434**	0.019	**0.021**	
1986	**0.122**	**0.126**	0.026	0.290	**0.394**	0.022	**0.020**	−0.055
1991	**0.144**	**0.136**	0.026	0.291	**0.355**	0.027	**0.020**	−0.184
Average								
1980	**0.147**	**0.169**	0.062	0.126	**0.394**	0.040	**0.062**	
1986	**0.192**	**0.190**	0.074	0.122	**0.321**	0.043	**0.058**	
1991	**0.192**	**0.217**	0.073	0.122	**0.305**	0.049	**0.042**	

Source: Chartered Institute for Public Finance and Accountancy (CIPFA) *Housing Accounts*, London.

ing low-cost apartment blocks using cheap building materials and low-cost construction methods.

Table 1 shows how, at the commencement of the RTB policy in 1980, council house stocks varied across local authorities. In Derby, for example, which is a relatively prosperous city specializing in skilled manufacturing occupations (such as aeronautics, railway equipment, etc.), the largest component of the council housing stock was 3 bedroom houses, mostly constructed in the pre-1939 period. This pattern is broadly replicated in the other local authorities illustrated in the table other than Hackney (Inner London) where the emphasis was on building apartments. The table also illustrates that, as the RTB policy evolved, it was the share of these larger and more desirable properties that declined as a share of total council properties. This reflects the composition of RTB sales over time, whereby "cherry-picking" at an early stage meant that more desirable houses were sold early in the process whereas less desirable properties came onto the market later in the process. Illustrating the latter point: data from the Department of Communities and Local Government (DCLG) shows that sales of apartments accounted for 7% of sales in 1986–87 but had risen to 37% of the total in 2014–15.[10] Finally, it should be noted from Table 1 that the reduction in the council house stock was fastest in areas with the most desirable properties, although some caution should be exercised on this finding given the association of housing stock type with political affiliation of local authorities. It is also interesting to note that Hackney (in common with other Inner London boroughs) continued to construct or acquire council housing during the post-1980 period, reflecting the pressures on social housing in London through most of the post-war period.

Although council housing is heterogeneous, we have less evidence on quality *within* housing types. Nevertheless most of the evidence from specialists in this area suggests that council houses were of lower quality than equivalent-sized private properties in terms of size of room, quality of build, size of backyards or gardens (if any) etc. Research on resale values of properties bought under RTB using data from estate agents (realtors) confirm this finding insofar as such properties resold at significant discounts in Birmingham, Glasgow, Leeds, and London relative to privately-constructed similar properties (Jones and Murie, 2006, pp.103–109). The same study illustrates that the acquisition and resale of RTB properties had significant effects on the composition of local housing markets. There is also qualitative evidence that the quality of builds declined over time, especially from the later 1950s when local authorities predominantly constructed low-cost apartment complexes. A careful search of the academic and professional literature for England and Wales has suggested that it is the reduction in quality of build rather than the cost inefficiencies of local authorities that generated most controversy. Whereas the literature in the United State has focused on the cost overruns and inefficiencies in the construction of public housing, it appears that in the United Kingdom, much tighter controls on costs led to a significant deterioration of quality rather than inefficiency. This point should not be over-emphasized, given the lack of quantitative evidence (particularly for earlier periods), but may arise from the tight control over financial arrangements by central government described in Section 1 of the paper.

We now turn to evidence on the character of council tenants and those who opted to exercise their Right to Buy their council property. The data are taken from 18 waves of the British Household Panel Survey (BHPS), a household survey very similar to the United States' Panel Survey of Income Dynamics. The first wave in the field of the BHPS was conducted in 1991 and the last wave that we utilize is 2008. We do not capture the early years of the RTB but, not only would we expect these disparate characteristics of council tenants and private occupiers to be even more pronounced

[10] DCLG (2016) Social Housing Sales, Table 681, London.

in the pre-1991 period of council house sales but, even within the period 1991–2008 we see a significant change in the fraction of council tenants in the sample. To include a measure of income volatility, we take all households that appear consecutively in at least 4 waves. This gives us a sample of more than 50,000 year-on-year responses. The survey asks a range of standard socioeconomic and demographic questions, as well as questions concerning housing tenure.

Of particular interest is that households are asked if they exercised their RTB option, and we use this information in the ensuing tables. Two points should be noted however: first a significant number appear to exit council house tenure without exercising RTB – this may be because of changing family and household circumstances, but may also be because the council house transferred their property to a social or community (not-for-profit) housing association to evade the initial RTB legislation (see the discussion in Section 1). To the extent that this last point is true, our differentiation of characteristics between council tenants and 'other tenures' will understate the differences in characteristics between those in private and social housing. Second, we do not know whether a council tenant was eligible for RTB if they did not buy (for reasons of eligibility - see Section 1 again). Hence we do know about potentially interesting households who may have been eligible to buy under the legislation but chose not to exercise that right.

Table 2 gives some descriptive statistics that confirm that there are differences both between council house tenants and other tenures, and also between residual council house tenants and those who chose in each period, or in past periods, to exercise their RTB option. It should also be noted that these are not only working age households; a significant proportion of these households will have retired from the workforce (as indicated by the average ages of heads of households in the table) which explains why employment rates are relatively low. The work status also refers to the head of household; other members of the household may have different patterns of economic activity.

Table 3 gives regression results concerning the correlates of being in council house tenure (relative to other tenures), moving in to council house tenure from another tenure (within the period) and exercising RTB within the period. The first column of results confirms the descriptive statistics: council tenants tend to have lower and more variable incomes, be marginally younger, be less likely to be married, more likely to be divorced or a single parent and have a lower probability of being either employed or self-employed. The second column considers entrants to the council house sector. They are very unlikely to have come from owner occupation, and more likely to shift from social or private renting or living with relatives. Interestingly, in the light of the discussion of our theoretical model, income and income volatility do not appear to be the main screening devices governing entry to the council house sector, but rather personal status (such as being a single parent) and also lack of employment or self-employment (which, of course, are likely to correlate with income). This shows how the current council house waiting list system 'tags' individuals not by their income per se but by their family status and employment status. Finally the third column would be expected to be the mirror image of the second. Although the predictive power is low, we show that those who exercise their RTB option are likely to be younger and to be respectively, more likely to have become employed or self-employed since entering the sector, and less likely to be unemployed.

4. Reforms to the RTB policy

The previous section showed that the social welfare implications of the RTB policy depend on the quality of the council housing stock. With high quality council houses, too much benefit is obtained by middle-wealth council tenants who are temporarily in poverty and exercise RTB at the expense of future low-wealth council housing applicants on the waiting list now and in the future. However, if the quality of council housing is lower, both current and future council tenants derive greater utility: in the former case by their higher gains in utility from exercising RTB, in the latter case from the higher residual stock of council housing. In this section, we study four adjustments of the RTB policy which might better target the policy on low-wealth households rather than disproportionately benefiting middle-wealth households which happened to be in possession of a council house by virtue of previous low income at the time the RTB policy was introduced. The reforms to the RTB policies to be investigated are: (i) reducing the discounts on RTB sales; (ii) loosening resale restrictions; (iii) returning the proceeds from RTB sales to local authorities for new council housing construction; and (iv) replacing the RTB with rent subsidies in cash.[11]

4.1. RTB with reduced discount

In the previous analysis, where we assumed that the average discounts on RTB sales equalled the rent subsidies given by local authorities to tenants, we showed that the aggregate welfare of low-wealth households would decrease were the RTB policy to induce a large number of middle-wealth households to take up the RTB option, leaving a reduced stock of council houses available for future generations of low-wealth householders. This would happen when the average quality of council houses was sufficiently high so as to attract middle-wealth households both to become council tenants in the past and then to exercise their right to purchase the house under the RTB policy. Hence the quality of council houses is a key variable when assessing reforms to the RTB policy.

In this subsection, we examine whether the aggregate welfare of low-wealth households can be improved by reducing the average discount rate that is applied to RTB sales. We model this as a reduction in the discount on the RTB house sale price relative to the rent subsidy received by existing tenants, i.e. by supposing that the discount on the sale price is only a fraction τ of the rent subsidy, where $0 \leq \tau < 1$. Of course, the utility of owning a house through RTB is strictly increasing in τ so that such a policy will, on the margin, reduce the number of applicants for RTB. However the implication of such a policy in general on low-wealth households depends on the average quality of council houses.

Reducing the discount on RTB houses when these are of low quality neither worsens nor improves the welfare of low-income households in general. From Proposition 1 in the previous section, when council houses are of quality below η^l, they attract no purchasers anyway. When houses are of quality above η^l but below η^m, only low-wealth purchasers are attracted to utilize the RTB policy to purchase their houses. A reduction in the discount

[11] An interesting possible reform that we do not consider in detail is that of targeting the subsidies for RTB purchase on low wealth tenants, not just because middle-wealth tenants already have strong incentives and resources with which to exercise RTB without a large subsidy, but also because the low wealth tenants are of primary concern in the planner's objective function. However, such a strategy would involve the acquisition of costly information, given that local authorities generally use tagging by characteristics rather than direct information on income to assess the priority list of council tenants. Leaving aside incentives to conceal information on incomes by existing council tenants, the signalling value of relatively short periods of income information is low, given that the stock of council tenants is composed of those with either persistent low incomes or highly volatile incomes. Hence council would have to acquire information on income dynamics over a relatively long period of time on all their tenants (including perhaps periods before they joined the queue for council housing) in order to sift out those who carry less weight in the planner's objective function. In addition, the eligibility requirements for RTB purchase require a minimum number of years' tenure: those with serially-correlated positive income shocks over short periods would probably leave the council house sector anyway by trading up to higher quality private rentals or house purchases.

Table 2
Characteristics of council house renters, RTB buyers and other households by period.

Period	1991–96	1997–2002	2003–08
% Council house tenants	16.5	14.8	11.7
% RTB buyers among tenants	2.6	5.2	5.6
Mean age of head of household			
Council house tenants	49.9	48.9	48.4
Right-to-Buy	46.7	43.7	45.3
Other tenures	45.7	46.5	47.7
Mean monthly income (£) (std dev)			
Council house tenants	860 (650)	1010 (740)	1175 (770)
Right-to-Buy	1385 (920)	1360 (940)	1420 (965)
Other tenures	1875 (1330)	1920 (1385)	2170 (1430)
Unemployment rate (%)			
Council house tenants	10.9	7.9	8.2
Right-to-Buy	1.2	5.6	2.0
Other tenures	4.1	2.6	2.1
Employment rate (%)			
Council house tenants	28.1	31.4	30.1
Right-to-Buy	53.9	50.1	45.7
Other tenures	56.3	57.9	58.5

Source: own calculations: British Household Panel Survey 1991–2008.

Table 3
Probability of head of household renting a council house, moving to council house tenure or exercising Right-to Buy (all periods).

Variable	Renting a council house(Sample: all tenures)		Moving to council house tenure(Sample: all tenures except council house)		Exercising option of Right to Buy(Sample: council house tenure only)	
	Coeff.	(std error)	Coeff.	(std error)	Coeff.	(std error)
Average income	0.048***	(0.006)	0.003	(0.002)	0.025	(0.014)
Std Dev income	0.026***	(0.006)	0.001	(0.002)	0.011	(0.009)
Age (years)	0.007***	(0.001)	0.001***	(0.000)	0.006***	(0.002)
Married=1	0.058***	(0.005)	0.004*	(0.002)	0.006	(0.009)
Divorced=1	0.015**	(0.005)	0.002	(0.002)	0.008	(0.008)
Single parent=1	0.030***	(0.006)	0.009***	(0.002)	0.020*	(0.009)
Employed	0.148***	(0.005)	0.013***	(0.001)	0.016*	(0.007)
Self-employed	0.179***	(0.006)	0.014***	(0.002)	0.039*	(0.016)
Unemployed	0.005	(0.009)	0.008***	(0.003)	0.021*	(0.001)
Time trend	0.001***	(0.000)	0.0002**	(0.0001)	0.003***	(0.000)
R^2	0.188		0.016		0.028	
Pr>	0.1282		0.0091		0.0843	
N	53438		46298		7140	

Notes: Sample: head of household only BHPS 1991–2008. Pooled cross-section estimates. Average and standard deviations of income over a minimum of 4 periods. Additional controls: number of children in 5 age categories. Quadratic in age of head of household, education attainment of head of household (4 categories), ethnic identity. Self-reported health status (8 categories). Omitted categories: widowed, retired, not in labour force. *p<0.05, ** pr<0.01, ***pr< 0.005.

on the price discourages some low-wealth households who would have gained utility by purchasing, but raises the welfare of future low-wealth households who will now be able to apply for council houses when current tenancies end. There may be intergenerational welfare changes among low-wealth households but there is no overall effect.

Reducing the discount on RTB sales does however increase the aggregate welfare of low-income households if it continues to induce low-wealth households to exercise RTB but discourages middle-wealth households from doing so. This can only happen if the quality of council houses is sufficiently high as to induce middle-wealth households to exercise RTB, which is the case where the average quality of council housing is higher than $\max\{\eta^m, \eta^l\}$. In such circumstances, a middle-wealth tenant might try to exercise RTB and to rent out the property to a low-wealth private tenant. But, as demonstrated in the previous section, the gains to exercising RTB are higher for a low-wealth council tenant than a middle-wealth tenant. Hence, as the discount on the sale price is reduced relative to the rent subsidy, it is middle-wealth tenants on the margin of the incentive to exercise RTB who are likely to cease to exercise RTB (perhaps considering other strategies such as moving into higher quality private rentals). This change in behavior shifts the social welfare benefits of the policy towards low-wealth households and hence increases the aggregate utility of low-wealth households, whether or not they choose to buy or subsequently seek a council house.

The results of reducing discounts on RTB houses are summarized in the following proposition, the proof of which is provided in Appendix B.2.

Proposition 2. *Reducing the discount on RTB sales improves the aggregate welfare of low-income households if and only if the RTB houses are of high enough quality to attract both low- and middle-wealth purchasers with no reduction but attract only low-wealth purchasers with the reduction in discount, which works if and only if the quality of RTB houses is above* $\max\left\{\eta^l, \eta^m, \eta^l_\tau\right\}$ *but below* η^m_τ, *where* η^l *and* η^m *solve Eq. (10), and* η^l_τ *and* η^m_τ *solve:*

$$\frac{u(Y^H - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - u(Y^H - R, 1, 0) - rFC\eta^l_\tau}{u(Y^L - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - u(Y^L - R\eta^l_\tau + T, \eta^l_\tau, 0) - rFC\eta^l_\tau} = 1 - \frac{1+r}{\lambda^l};$$
$$\frac{u(Y^H - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - u(Y^H - R, 1, 0) - rFC\eta^m_\tau}{u(Y^L - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - u(Y^L - R, 1, 0) - rFC\eta^m_\tau} = 1 - \frac{1+r}{\lambda^m}. \quad (11)$$

4.2. Loosening resale restrictions

A second policy reform to consider is to loosen the resale restriction on RTB houses such that RTB purchasers can resell their properties in the open market. Again, the welfare effect of such a

policy depends on several factors: the income of RTB purchasers, the quality of RTB houses, and the rent subsidies on council housing provided by the central government. In this section, we consider loosening resale restrictions in the form that a RTB purchaser has to return a fraction θ of the discount on the original RTB sale to the local authority if he or she resells the house and moves to a private property, where $\theta \in [0, 1]$. The local authority then uses this returned discount to subsidize new council tenants or RTB purchasers.

First, loosening resale restrictions has no effect on purchasers of high quality RTB houses. By Proposition 1, RTB houses attract both low- and middle-wealth purchasers if the quality is higher than $\max\{\eta^l, \eta^m\}$. Council tenants who exercise RTB on these high quality council houses prefer living in their owned RTB properties to renting private houses even if they receive the high income in the subsequent periods. Hence, when the local authorities loosen the resale restrictions on RTB houses of quality higher than $\max\{\eta^l, \eta^m\}$, both low- or middle-wealth RTB homeowners would rather live in their owned RTB houses than resell their RTB houses in the open market even if they can retain the full amount of housing subsidies after the resale. Thus, loosening resale restrictions has no effect on RTB houses of quality higher than $\max\{\eta^l, \eta^m\}$.

Second, RTB houses of quality lower than η^l that attract no purchaser stay unsold under looser resale restrictions. A RTB purchaser has to pay a fixed cost (in utility) of owning a house, hence a household is uninterested in exercising RTB when his or her gain from owning the RTB house is not enough to cover the cost of purchasing the house. When the quality of council housing is sufficiently low, a low-wealth household is unable to obtain a large enough gain from living in an owned RTB house in low-income periods to outweigh the fixed cost of purchasing the house. Therefore, even though resale restrictions are loosened, middle-wealth RTB purchasers are unable to find a buyer among low-wealth tenants. It is also suboptimal to exercise RTB on a low-quality house and then resell it back to the local authority in order simply to obtain the price subsidy (discount) from the central government.

Third, loosening resale restrictions may affect the propensity to exercise RTB for council tenants in houses of quality higher than η^l but lower than η^m. This depends on the discount that can be retained from a RTB resale, defined as $\tau(1-\theta)$, where τ is the discount provided on RTB sales, $1-\theta$ is the fraction of the original discount that can be retained after a resale, $\tau \geq 0$, and $\theta \in [0, 1]$. By Proposition 1, with resale restrictions, middle-wealth households are not interested in RTB houses of quality higher than η^l but below η^m. When the resale restriction is lifted, middle-wealth households become interested in purchasing these RTB houses in order to resell them to low-wealth households if they are able to keep a large amount of the discount after resale. It happens if and only if the discount that is retained after resale $\tau(1-\theta)$ is larger than D, where D solves:

$$\frac{u(Y^H - R + DT, 1, 1) - u(Y^H - R, 1, 0) - rFC}{u(Y^L - R + DT, 1, 1) - u(Y^L - R, 1, 0) - rFC} = 1 - \frac{1+r}{\lambda^m}. \quad (12)$$

However, when the discount on RTB houses is set such that the optimal rent subsidies in the original council housing rental system are satisfied, that is, $\tau = 1$, both low- or middle-wealth RTB homeowners would rather live in their owned RTB houses than resell their RTB houses in the open market even if they can retain the full amount of housing subsidies after the resale, and hence, loosening resale restrictions has no effect on RTB houses. The results of loosening resale restrictions on RTB houses are summarized in the following proposition, the proof of which is provided in Appendix B.3.

Proposition 3. *When the discount on RTB houses equals the optimal rent subsidy, loosening resale restrictions has no effect on RTB sales.*

4.3. RTB with new construction

Until now, we assumed no new council housing is constructed using the receipts of RTB. This accords with the evidence presented in the discussion in Section 1 and the evidence in Chart 3. In this subsection, we investigate how social welfare changes if the local authorities use the proceeds of high quality RTB sales to construct new council houses. This is done within a balanced budget setting; whereby the authorities are able to reduce discounts on RTB sales but increase the number of council properties within the fixed budget on council housing, B.

We focus on high quality RTB housing in our investigation here. As shown in the results of the previous subsection, reducing the discount on RTB sales of high quality RTB houses cannot help to reduce the number of low-income tenants on the waiting list for council housing. Both low- and middle-wealth council tenants exercise RTB either with or without the reduction in discount on houses of quality higher than $\max\left\{\eta^l, \eta^m, \eta^l_\tau, \eta^m_\tau\right\}$, where η^l and η^m solve Eq. (10), and η^l_τ and η^m_τ solve Eq. (11). We will explore in the following analysis whether using the proceeds from RTB sales to replace part of the council housing stock improve the aggregate welfare of low-income households and how this change in welfare depends on the average quality of council houses.

When the quality of RTB houses is high enough to attract middle-wealth purchasers despite the reduced discount on sales, local authorities can improve the aggregate welfare of low-income tenants by using the proceeds from RTB sales to construct new council houses for future low-income tenants or low-wealth RTB purchasers. The proceeds from RTB sales increase when the discount given on RTB houses decreases. The problem becomes whether the local authorities can improve the welfare of low-income households within their budget by reducing the discount on RTB houses and using the proceeds to construct new council housing for low-income applicants who have to rent privately and are currently on the council-house waiting list.

In order to prioritize housing for low-wealth households, the quality of new council housing constructed by using RTB proceeds should be low. Otherwise, middle-wealth council tenants continue to exercise RTB and hence reduce the stock of newly-constructed council housing. Thus, the local authorities have to construct new council houses of sufficiently low quality in order to attract either low-wealth RTB purchasers or no purchaser at all. The results of the new construction refinement of the RTB policy are summarized in the following proposition, the proof of which is provided in Appendix B.4.

Proposition 4. *Using the proceeds from reduced-discount sales of RTB houses of quality higher than* $\max\left\{\eta^l, \eta^m, \eta^l_\tau, \eta^m_\tau\right\}$ *to construct new RTB houses for wait-list applicants improves the aggregate welfare of low-income households if and only if the quality of newly constructed council houses is above* $\widetilde{\eta}^l$ *but below* $\widetilde{\eta}^m$ *if* $\widetilde{\eta}^l < \widetilde{\eta}^m$, *and below* $\widetilde{\eta}^l$ *otherwise, where* η^l *and* η^m *solve Eq. (10),* η^l_τ *and* η^m_τ *solve Eq. (11), and* $\widetilde{\eta}^l$ *and* $\widetilde{\eta}^m$ *solve Eq. (11) with* T *replaced by* $\widetilde{T} \equiv \frac{(1-\lambda^l)N^l + (1-\lambda^l)N^m}{\lambda^l(1-\lambda^l)N^l + \lambda^m(1-\lambda^l)N^m}(1-\tau)T$.

The idea that the social welfare could be improved by replacing RTB sales with low quality public housing is not new. The revised RTB policy in 2012 increased the availability of funds from RTB sales to local councils in order to allow them to construct new properties. The government's requirement was that the funds be used to replace the sold-by-RTB houses one for one, but at lower quality. The implication of our examination of the new construction refinement of RTB provides some evidence in support of this revised government policy.

4.4. Replacing RTB with rent subsidies in cash

Replacing the RTB with rent subsidies in cash may be another alternative to improve the aggregate welfare of low-income households. Initially, we consider the setting where local authorities provide low-income tenants with council houses of lower quality than equivalently-sized privately-owned properties. Instead of providing council housing of lower quality to low-income tenants, the local authorities can provide them with housing subsidies in cash to rent private houses. Then low-income tenants receive the housing subsidies equal to T each period to rent private houses. Whether low-income tenants who receive rent subsidies obtain higher utility from renting high-quality private houses than lower-quality council ones depends on the housing budget from the central government. The optimal council housing rental policy and its impact on the aggregate welfare of low-income households are summarized in the following proposition (detailed proofs are provided in Appendix 5).

Proposition 5. *It is optimal for the local authorities to provide low-income tenants with rent subsidies in cash instead of council houses of lower quality than private ones if and only if the amount of housing subsidies is no less than $Y^H - Y^L$ per low-income tenant.*

When local authorities provide rent subsidies in cash instead of low-quality council housing to low-income tenants, in order to improve their welfare to the same level, low-income households have to be over-subsidized as if they receive the high income.

In reality the quality of council houses is lower than the private sector, and low-wealth households are prepared to live in lower quality houses, hence it is hard to improve the aggregate welfare of low-wealth households by replacing council houses with cash subsidies. The budget on housing received from the central government is limited. It is not feasible to subsidize low-income tenants with large rent subsidies in cash such that their incomes are no less than high-income households. Thus, it is optimal for the local authorities to provide both housing subsidies and council houses of lower quality than private ones to low-income tenants instead of offering them only rent subsidies in cash. Replacing the RTB with rent subsidies in cash alone cannot improve the aggregate welfare of low-income households under these assumptions.

5. Conclusion

This paper has provided what we believe to be the first analysis from a theoretical perspective of the innovative national 'Right to Buy' (RTB) policy for selling public housing to public tenants in the UK. The policy was the largest single privatization in the period from 1980 to the mid-2000s, raising considerable sums for central government and increasing the share of owner occupation in the UK by almost 15 percentage points. Having described the growth and original rationale for public housing, the paper examines the development and evolution of the RTB policy over time, and its implications for the stock of public (council) housing.

To provide a theoretical underpinning for policy evaluation, the model assumed that council tenants – and therefore potential RTB purchasers – are heterogeneous, and that some of their characteristics, such as wealth and future incomes, are unobservable to local authorities (council house suppliers). The policy tools available to the local authority are the interrelated decisions (within a fixed construction budget) of what quality of council houses to construct and whether to house all applicants for council-house tenancy or to create a waiting list for council houses, which thereby reveals more information about potential tenants under consideration, but at the cost of being unable to house all deserving applicants. Crucially, we demonstrate that the RTB policy itself may affect the subsequent composition of applicants for council houses and therefore the composition of residual council tenants as some tenants choose to exercise their preference for RTB.

As in standard housing tenure models, the decision of council tenants to exercise RTB (and to retain ownership of the property having exercised their RTB) hinges on the household's preference for ownership over renting. However additional factors specific to the policy context are the average quality of RTB properties, a policy decision of the local authority as described above, and the magnitude of the discount given to would-be RTB purchasers. We explore the implications of these parameters on the household's decision to exercise RTB, and on the evolving composition of tenants in the public sector versus owners. We use empirical data to confirm some of these findings.

We then considered four potential reforms of the RTB program: reducing discount on RTB sales, loosening resale restrictions, allowing local authorities to retain RTB receipts for new construction, and briefly discussing the issue of replacing council houses by rent subsidies in cash. We demonstrate that whether these policies have any impact on RTB decisions hinges crucially on assumptions concerning the parameters described above. For example, resale restrictions will only affect behavior where council houses are of intermediate quality. Conversely, reducing discounts only affects behavior when council houses are of 'high' quality. If the planner's social welfare function is intended to maximise the aggregate welfare of current and future low-wealth households who would otherwise be denied access to the private market, the implications of council house quality are quite different in these two policy scenarios. In similar vein, we suggest that returning receipts from RTB sales to local authorities (a reform constantly suggested by critics of the policy) is most effective with the proviso that receipts are used primarily and explicitly to subsidize constructions of low-quality ('affordable') houses. It is of interest to note that this last policy refinement was introduced recently.

Although we believe that this paper makes progress in evaluating the RTB policy, we have had to make key assumptions about the parameters of the program – for example as to the relation between the discount rate on RTB sales and the rent subsidy. This gives the policy a great coherence in theory than in practice, since there is little evidence of co-ordination of public housing policy between central government and local authorities in the UK in practice. Any overall evaluation of the policy would therefore also require further investigation of the dynamics of the relationship between central and local government in the UK – which is a task for a separate paper.

Appendix A. Charts and tables

Chart 1
Housing tenure shares by tenure type: England and Wales 1918-2011
Source: ONS 'A Century of home ownership in England and Wales

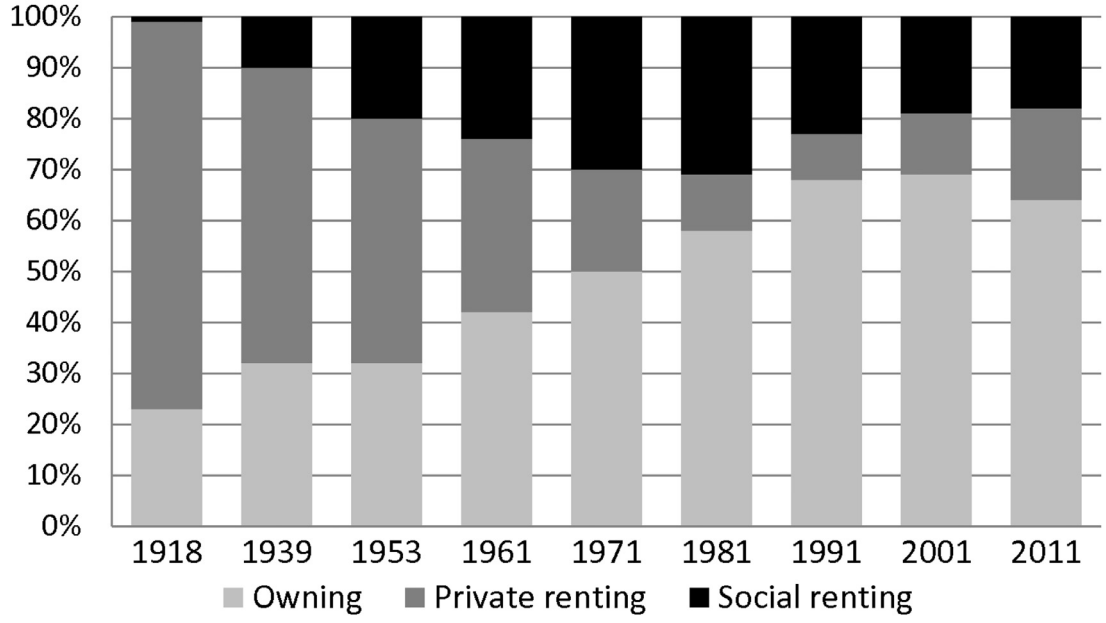


Chart 2
Residential construction in England and Wales 1923-24 to 2014 by public and private sector
Sources: Mitchell (1988) and Department of Communities and Local Government *Housing Statistics* Tables 244 and 245

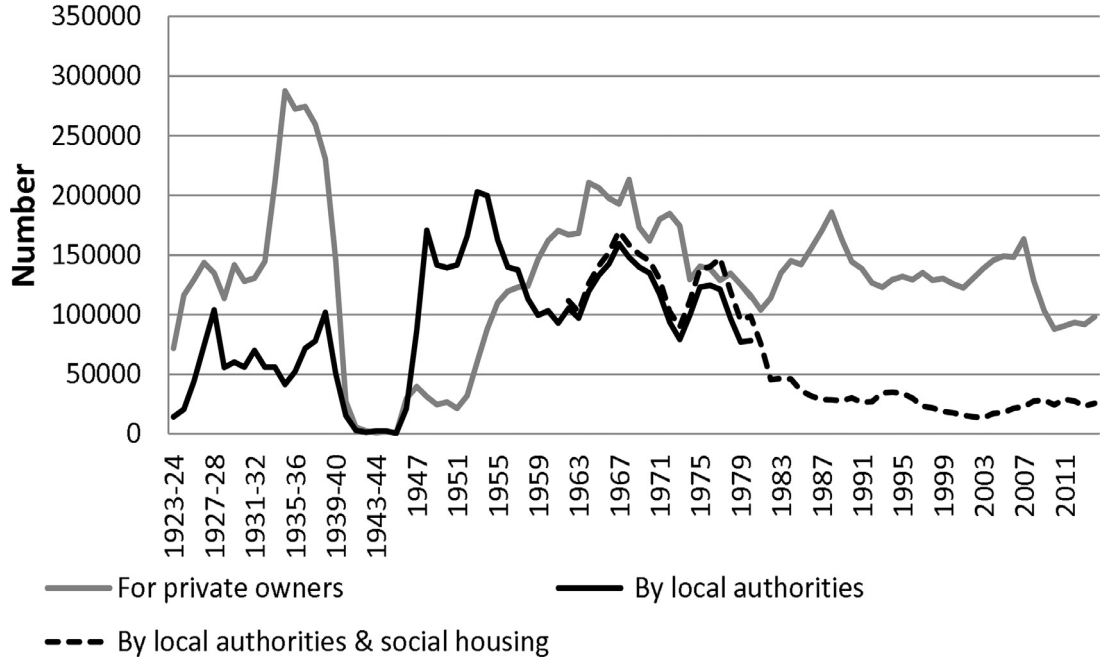
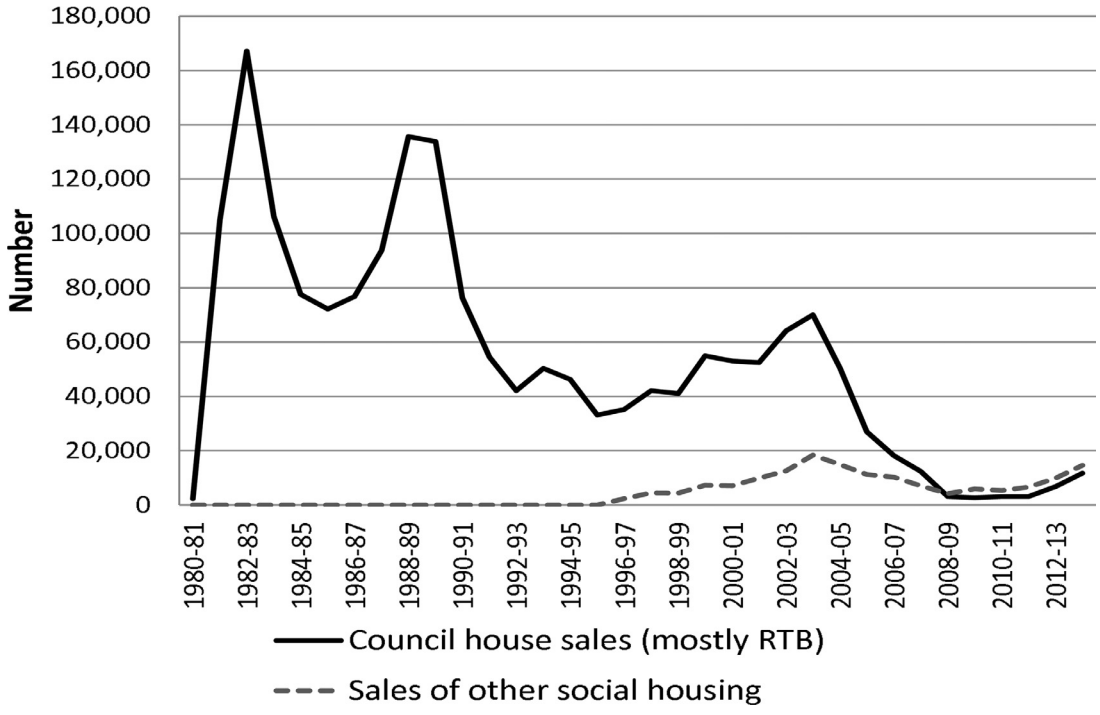


Chart 3
Right to-Buy and other sales of public housing in England 1980-81 to 2013-14
Source: Department of Communities and Local Government *Housing Statistics* Tables 678



Appendix B. Proofs of Propositions

B1. Proof of Proposition 1

High-income RTB tenants who prefer high-quality private houses are able to rent out their properties to low-income tenants who always prefer renting RTB houses to private houses:

$$\begin{aligned} &u(Y^L - R, 1, 0) - u(Y^L - R\eta, \eta, 0) \\ &= \int_{\eta}^{1} \left(-Ru_C(Y^L - Rx, x, 0) + u_H(Y^L - Rx, x, 0)\right)dx \\ &< \int_{\eta}^{1} \left(-Ru_C(Y^L - Rx + T, x, 0) + u_H(Y^L - Rx + T, x, 0)\right)dx \\ &< \int_{\eta}^{1} \left(-Ru_C(Y^L - R\eta + T, \eta, 0) + u_H(Y^L - R\eta + T, \eta, 0)\right)dx = 0, \end{aligned}$$

where the first inequality comes from $-Ru_{CC} + u_{HC} > 0$ and the second inequality comes from $R^2u_{CC} - Ru_{CH} - Ru_{HC} + u_{HH} < 0$. Thus, high-income RTB homeowners are always able to rent out their RTB houses to low-income tenants who are unable to obtain council housing from the local authorities, and hence their utility in high-income periods before paying the cost of owning RTB houses is bounded by $u(Y^H - R + T, 1, 0)$ when they rent privately.

At equilibrium, a low-income council tenant exercises the RTB if and only if the value of exercising RTB, V^i_{RTB}, is larger than the value of continuing as a tenant, V^i_T, $i \in \{m, l\}$. The difference in the value of exercising the RTB and continuing as a tenant for a middle-wealth ($i = m$) or low-wealth ($i = l$) council tenants is:

$$\begin{aligned} r\left(V^i_{RTB} - V^i_T\right) = &-rFC\eta + \frac{\lambda^i}{1+r}\max\left\{u(Y^H - R\eta + T, \eta, 1), u(Y^H\right. \\ &\left.-R + T, 1, 0)\right\} + \left(1 - \frac{\lambda^i}{1+r}\right)\left(u(Y^L - R\eta + T, \eta, 1)\right. \\ &\left.-\gamma\left(u(Y^L - R\eta + T, \eta, 0) - u(Y^L - R, 1, 0)\right)\right) \\ &-\frac{\lambda^i}{1+r}u(Y^H - R, 1, 0) - \left(1 - \frac{\lambda^i}{1+r}\right)u(Y^L - R, 1, 0). \end{aligned}$$

Since $-Ru_{CC} + u_{HC} > 0$, living in a higher quality RTB house relative to renting it increases a high-income owner's utility by a larger amount than a low-income owner. Also, as $R^2u_{CC} - Ru_{CH} - Ru_{HC} + u_{HH} < 0$, low-income tenants' marginal utility with respect to housing quality is larger than the marginal cost in utility of owning a house, as stated in Eq. (5) in Assumption 1. Thus, we have:

$$\begin{aligned} &-Ru_C(Y^H - R\eta + T, \eta, 1) + u_H(Y^H - R\eta + T, \eta, 1) - rFC \\ &> -Ru_C(Y^L - R\eta + T, \eta, 1) + u_H(Y^L - R\eta + T, \eta, 1) - rFC > 0. \end{aligned}$$

Then living in an owned RTB house improves the utility of a council tenant who receives the low income if and only if the quality of the RTB house is larger than $\underline{\eta}$, where $\underline{\eta}$ solves:

$$u(Y^L - R\underline{\eta} + T, \underline{\eta}, 1) - u(Y^L - R\underline{\eta} + T, \underline{\eta}, 0) = rFC\underline{\eta}.$$

High-income RTB homeowners obtain higher utility than high-income private tenants by renting out their properties to low-

income tenants if and only if the RTB houses are of quality below $\frac{u(Y^H-R+T,1,0)-u(Y^H-R,1,0)}{rFC}$. Hence both middle- and low-wealth council tenants exercise the RTB when the quality of the RTB houses is within $(\underline{\eta}, \frac{u(Y^H-R+T,1,0)-u(Y^H-R,1,0)}{rFC})$. And high-income RTB homeowners rent out their properties to low-income tenants and rent higher quality private housing if and only if the RTB houses are of quality below $\widehat{\eta}$, where:

$$u(Y^H - R\widehat{\eta} + T, \widehat{\eta}, 1) - u(Y^H - R + T, 1, 0) = 0.$$

However, since $-Ru_{CC} + u_{HC} > 0$, when RTB houses are of quality below $\widehat{\eta}$, low-income RTB homeowners prefer renting private houses to living in owned RTB houses. They would not purchase the RTB houses of quality below $\widehat{\eta}$ in the first place. Thus, $\underline{\eta} > \widehat{\eta}$. The RTB houses which attract RTB purchasers to live in owned RTB houses rather than rent out their properties in the open market are of relatively high quality such that the RTB homeowners would rather live in the houses even if they receive the high income in the future. Therefore, RTB homeowners continue living in their owned properties after exercising the RTB.

On contrast, when the quality of council housing is larger than $\bar{\eta}$ such that high-income households also generate higher utility living in owned RTB houses compared to renting council houses, both middle- or low-wealth council tenants exercise the RTB, where $\bar{\eta}$ solves:

$$u(Y^H - R\bar{\eta} + T, \bar{\eta}, 1) - u(Y^H - R, 1, 0) = rFC\bar{\eta}.$$

Take the first derivatives of the difference in the values between exercising the RTB and continuing as a tenant with respect to η and T, respectively, we have:

$$\begin{aligned}\frac{\partial}{\partial \eta} r\left(V^i_{RTB} - V^i_T\right) &= \left(1 - \frac{\lambda^i}{1+r}\right)\left(-Ru_C(Y^L - R\eta + T, \eta, 1)\right.\\ &\quad \left.+u_H(Y^L - R\eta + T, \eta, 1)\right)\\ &\quad -rFC + \frac{\lambda^i}{1+r}\left(-Ru_C(Y^H - R\eta + T, \eta, 1)\right.\\ &\quad \left.+u_H(Y^H - R\eta + T, \eta, 1)\right) > 0;\\ \frac{\partial}{\partial T} r\left(V^i_{RTB} - V^i_T\right) &= \left(1 - \frac{\lambda^i}{1+r}\right)\left(u_C(Y^L - R\eta + T, \eta, 1)\right.\\ &\quad \left.-\gamma u_C(Y^L - R\eta + T, \eta, 0)\right)\\ &\quad + \frac{\lambda^i}{1+r}u_C(Y^H - R\eta + T, \eta, 1) > 0.\end{aligned}$$

Then $r\left(V^i_{RTB} - V^i_R\right)$ is strictly increasing in either the housing quality, η, or the housing subsidies (or transfer payment) from the central government, T. Since low-wealth households have higher probability of receiving the low income than middle-wealth households do $(1 - \lambda^l > 1 - \lambda^m)$, low-wealth council tenants have higher value of exercising low quality RTB houses than middle-wealth council tenants. Thus, the RTB houses of quality higher than η^l attracts low-wealth council tenants, where η^l solves:

$$\frac{u(Y^H - R\eta^l + T, \eta^l, 1) - u(Y^H - R, 1, 0) - rFC\eta^l}{u(Y^L - R\eta^l + T, \eta^l, 1) - u(Y^L - R\eta^l + T, \eta^l, 0) - rFC\eta^l} = 1 - \frac{1+r}{\lambda^l}.$$

Low-income RTB homeowners prefer living in their RTB houses of quality above η^l, hence they do not rent out their properties when they receive the high income, otherwise, they rent out their properties when receiving the low income also, which is a contradiction. Thus, $\eta^l > \widehat{\eta}$. When low-wealth council tenants exercise the RTB, the stock of council houses in the local authorities' hand decreases over time. Middle-wealth council tenants foresee the decrease in possibility to obtain council housing in the future and are interested in exercising the RTB when they prefer owning the RTB houses to continuing as private tenants. Then middle-wealth council tenants are interested in exercising the RTB when the council housing quality is above $\max\{\eta^l, \eta^m\}$, where η^m solves:

$$\frac{u(Y^H - R\eta^m + T, \eta^m, 1) - u(Y^H - R, 1, 0) - rFC\eta^m}{u(Y^L - R\eta^m + T, \eta^m, 1) - u(Y^L - R, 1, 0) - rFC\eta^m} = 1 - \frac{1+r}{\lambda^m}.$$

They also continue to live in their RTB properties when they receive the high income. No tenant is interested in exercising the RTB if the quality of the houses is below η^l, which are left for future low-income council tenants. Thus, when the council housing is of quality higher than $\max\{\eta^l, \eta^m\}$, both middle- and low-wealth council tenants exercise the RTB and continue living in their RTB properties thereafter; when the quality is within the range $(\eta^l, \max\{\eta^l, \eta^m\})$, only low-wealth council tenants exercise the RTB and continue living in their RTB properties thereafter; no council tenant is interested in the RTB houses of quality below η^l. Therefore, the aggregate per-period welfare of low-income households under the RTB relative to renting private houses is:

$$\begin{cases} X\left(1 - \lambda^l\right)\Delta W_{RTB}, & \text{if } \max\left\{\eta^l, \eta^m\right\} > \eta > \eta^l;\\ X\left(1 - \lambda^l - \left(\lambda^m - \lambda^l\right)\right. & \\ \left.\times(1 - \lambda^m)\frac{N^m}{X}\right)\Delta W_{RTB}, & \text{if } \eta > \max\left\{\eta^l, \eta^m\right\}.\end{cases}$$

where X is the measure of either middle- or low-wealth low-income households hence $X = \left(1 - \lambda^l\right)N^l + (1 - \lambda^m)N^m$, and the increment in a low-income household's utility from living in an owned RTB house of quality η, $\eta < 1$, to renting a private house of quality one is:

$$r\Delta W_{RTB} = u(Y^L - R\eta + T, \eta, 1) - rFC\eta - u(Y^L - R, 1, 0).$$

When the quality of RTB houses is extremely low (below η^l) such that no council tenant exercises the RTB, there is no change in the aggregate welfare of low-income households. When the quality of RTB houses is above η^l, the RTB improve the aggregate welfare of low-income households if and only if the welfare gain of low-income RTB homeowners outweighs the welfare loss of low-income tenants not being able to get council houses from the local authorities. With ΔW defined as the increase in a low-income council tenant's utility relative to renting a private house, as stated in Eq. (8), the RTB improves the aggregate welfare of the low-income households if and only if the following inequalities are satisfied:

$$\begin{cases} \frac{\Delta W_{RTB} - \Delta W}{\Delta W} > \frac{\lambda^l}{1 - \lambda^l}, & \text{if } \max\left\{\eta^l, \eta^m\right\} > \eta > \eta^l;\\ \frac{\Delta W_{RTB} - \Delta W}{\Delta W} & \\ > \frac{\lambda^l\left(1 - \lambda^l\right)N^l + \lambda^m(1 - \lambda^m)N^m}{\left(1 - \lambda^l\right)^2 N^l + (1 - \lambda^m)^2 N^m}, & \text{if } \eta > \max\left\{\eta^l, \eta^m\right\};\end{cases}$$

where the difference in the improvement of low-income households' utility generated from living in owned RTB houses relative to renting council houses from the local authorities is:

$$\begin{aligned}r(\Delta W_{RTB} - \Delta W) &= u(Y^L - R\eta + T, \eta, 1)\\ &\quad -u(Y^L - R\eta + T, \eta, 0) - rFC\eta.\end{aligned}$$

Because low-wealth households have almost zero probability of receiving the high income in the future, λ^l is close to zero, introducing the RTB to houses of quality lower than $\max\{\eta^l, \eta^m\}$ improves the aggregate welfare of low-income households; but introducing the RTB to higher quality council houses may decrease the aggregate welfare of the low-income households since middle-wealth households who have higher probability of receiving the high income in the future are also interested in exercising RTB and occupy

the RTB houses thereafter. The council houses left for future council tenants are of quality below η^l, in which case no council tenant is interested in exercising RTB.

B2. Proof of Proposition 2

By Proposition 1, low-wealth council tenants exercise RTB on houses of quality higher than η^l; and when low-wealth council tenants exercise RTB, middle-wealth council tenants foresee the decrease in possibility to obtain council housing in the future and are interested in exercising RTB when they prefer living in owned RTB houses to renting private houses and hence exercise RTB on houses of quality above $\max\{\eta^l, \eta^m\}$, where η^l and η^m satisfy Eq. (10).

With the reduced discount on RTB sales, the local authorities provide a fraction τ of the price subsidies to RTB homeowners, then low-wealth council tenants are interested in exercising RTB on houses of quality higher than η^l_τ, where η^l_τ solves:

$$\frac{u(Y^H - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - u(Y^H - R, 1, 0) - rFC\eta^l_\tau}{u(Y^L - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - u(Y^L - R\eta^l_\tau + T, \eta^l_\tau, 0) - rFC\eta^l_\tau} = 1 - \frac{1+r}{\lambda^l}.$$

When low-wealth council tenants exercise RTB, middle-wealth council tenants foresee the decrease in possibility to obtain council housing in the future and exercise RTB when the council housing quality is above $\max\left\{\eta^l_\tau, \eta^m_\tau\right\}$, where η^m_τ solves:

$$\frac{u(Y^H - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - u(Y^H - R, 1, 0) - rFC\eta^m_\tau}{u(Y^L - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - u(Y^L - R, 1, 0) - rFC\eta^m_\tau} = 1 - \frac{1+r}{\lambda^m}.$$

Then the cutoff quality of RTB houses above which low- or middle-wealth council tenants exercise RTB decreases with the fraction of housing subsidies from the central government that RTB homeowners retain (τ), which increases in the discount on RTB sales, because:

$$\begin{aligned}\frac{d\eta^l_\tau}{d\tau} = &-\Big(\frac{1+r-\lambda^l}{\lambda^l}\big(-Ru_C(Y^L - R\eta^l_\tau + \tau T, \eta^l_\tau, 1)\\ &+u_H(Y^L - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - rFC\big)\\ &+\big(-Ru_C(Y^H - R\eta^l_\tau + \tau T, \eta^l_\tau, 1)\\ &+u_H(Y^H - R\eta^l_\tau + \tau T, \eta^l_\tau, 1) - rFC\big)\Big)^{-1}\\ &\cdot\Big(\frac{1+r-\lambda^l}{\lambda^l}u_C(Y^L - R\eta^l_\tau + \tau T, \eta^l_\tau, 1)\\ &+u_C(Y^H - R\eta^l_\tau + \tau T, \eta^l_\tau, 1)\Big)T < 0;\end{aligned}$$

$$\begin{aligned}\frac{d\eta^m_\tau}{d\tau} = &-\Big(\frac{1+r-\lambda^m}{\lambda^m}\big(-Ru_C(Y^L - R\eta^m_\tau + \tau T, \eta^m_\tau, 1)\\ &+u_H(Y^L - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - rFC\big)\\ &+\big(-Ru_C(Y^H - R\eta^m_\tau + \tau T, \eta^m_\tau, 1)\\ &+u_H(Y^H - R\eta^m_\tau + \tau T, \eta^m_\tau, 1) - rFC\big)\Big)^{-1}\\ &\cdot\Big(\frac{1+r-\lambda^m}{\lambda^m}u_C(Y^L - R\eta^m_\tau + \tau T, \eta^m_\tau, 1)\\ &+u_C(Y^H - R\eta^m_\tau + \tau T, \eta^m_\tau, 1)\Big)T < 0.\end{aligned}$$

Thus, reducing the discount on RTB sales (a decrease in τ) increases the quality of RTB houses above which either low- or middle-wealth council tenants are interested in owning. Also, the difference in the improvement of low-income households' utility generated from living in owned RTB houses relative to renting council houses from the local authorities is:

$$\begin{aligned}r(\Delta W_{RTB} - \Delta W) &= u(Y^L - R\eta + \tau T, \eta, 1)\\ &\quad - u(Y^L - R\eta + T, \eta, 0) - rFC\eta,\end{aligned}$$

which decreases with the reduction in the discount on RTB sales. Thus, reducing the discount on RTB sales improve aggregate welfare of low-income households if and only if the quality of RTB houses is above $\max\{\eta^l, \eta^m\}$ such that both low- and middle-wealth council tenants are interested in exercising RTB without the reduction but attract only low-wealth purchasers with the reduction, that is, above η^l_τ and below η^m_τ.

B3. Proof of Proposition 3

When the discount on RTB houses is set such that the optimal rent subsidy in the original council housing rental system is satisfied, at equilibrium, the quality of council houses optimizes low-income tenants' utility. Then without the adjustment cost of owning houses, low-income RTB homeowners always prefer living in their owned RTB properties to renting private houses, that is:

$$u(Y^L - R\eta + T, \eta, 1) > u(Y^L - R\eta + T, \eta, 0) \geq u(Y^L - R + T, 1, 0).$$

Since $-Ru_{CC} + u_{HC} > 0$, high-income households generate higher utility owning relative to renting houses than low-income households. RTB homeowners prefer continuing living in their RTB properties to renting private houses even if they are able to retain the housing benefit by either renting out or reselling their properties. Thus:

$$u(Y^H - R\eta + T, \eta, 1) > u(Y^H - R + T, 1, 0).$$

Therefore, it is optimal for RTB homeowners who have exercised RTB to continue living in their owned properties even if they receive the high income in the future. The difference in the value of exercising the RTB and continuing as a tenant for a middle-wealth ($i = m$) or low-wealth ($i = l$) council tenant becomes:

$$\begin{aligned}r\left(V^i_{RTB} - V^i_T\right) = &-rFC\eta + \frac{\lambda^i}{1+r}\big(u(Y^H - R\eta + T, \eta, 1)\\ &-u(Y^H - R, 1, 0)\big)\\ &+\left(1 - \frac{\lambda^i}{1+r}\right)\big(u(Y^L - R\eta + T, \eta, 1)\\ &-\mathbb{I}_{[i=l]}u(Y^L - R\eta + T, \eta, 0) - \mathbb{I}_{[i=m]}u(Y^L - R, 1, 0)\big).\end{aligned}$$

By Proposition 1, RTB houses of quality higher than η^l are occupied at equilibrium. The homeowners are uninterested in reselling their properties even if they receive the high income in the future. Without resale restrictions, the benefit of exercising RTB on houses of quality lower than η^l is still not enough to cover the adjustment cost of owning houses, and hence no council tenant purchase RTB houses of quality below η^l. Thus, loosening resale restrictions on RTB houses of any quality has no effect on the aggregate welfare of low-income households under the RTB policy that is consistent with the optimal rent subsidy.

B4. Proof of Proposition 4

When using the proceeds from the reduced discount on RTB sales to construct new council houses, the local authorities provide a fraction τ of the housing subsidies to RTB homeowners, and the rest $1-\tau$ fraction of the housing subsidies are transferred to new low-income tenants or new RTB purchasers. The proceeds from RTB sales is $(1-\tau)TX$, where $X = \left(1-\lambda^l\right)N^l + (1-\lambda^m)N^m$. The measure of future low-income tenants is $\lambda^l\left(1-\lambda^l\right)N^l + \lambda^m(1-\lambda^m)N^m$. Thus, the housing subsidy that can be provided to each low-income tenant is:

$$\widetilde{T} = \frac{\left(1-\lambda^l\right)N^l + (1-\lambda^m)N^m}{\lambda^l\left(1-\lambda^l\right)N^l + \lambda^m(1-\lambda^m)N^m}(1-\tau)T.$$

Then by Proposition 1, low-wealth council tenants are interested in exercising RTB on houses of quality higher than $\widetilde{\eta}^l$, and middle-wealth council tenants foresee the decrease in possibility to obtain council housing in the future and exercise RTB when the council housing quality is above $\max\left\{\widetilde{\eta}^l, \widetilde{\eta}^m\right\}$, where $\widetilde{\eta}^l$ and $\widetilde{\eta}^m$ solve Eq. (10) with T replaced by $\widetilde{T}$. Thus, in order to maximize the aggregate welfare of future low-income households, the local authorities construct new council houses of quality above $\widetilde{\eta}^l$ and below $\widetilde{\eta}^m$, if exist, for low-wealth RTB purchasers, otherwise, they construct new council houses of quality below $\widetilde{\eta}^l$ for low-income tenants who are of either low or middle wealth.

The aggregate welfare of low-income RTB homeowners when the discount on a RTB sale is reduced to a fraction τ of the housing subsidy from the central government becomes:

$$\left(\left(1-\lambda^l\right)^2 N^l + \left(1-\lambda^l\right)^2 N^m\right) W^{\tau}_{RTB},$$

where the utility of a low-income RTB homeowner is:

$$rW^{\tau}_{RTB} = u(Y^L - R\eta + \tau T, \eta, 1) - rFC\eta.$$

The optimal welfare of future low-income households, who are either RTB homeowners or council tenants, is:

$$\begin{cases} \left(1-\lambda^l\right)\left(\lambda^l\left(1-\lambda^l\right)N^l \right. \\ \left. +\lambda^m(1-\lambda^m)N^m\right)\widetilde{W}_{RTB}, & \text{if } \widetilde{\eta}^m > \widetilde{\eta} > \widetilde{\eta}^l; \\ \left(\lambda^l\left(1-\lambda^l\right)N^l + \lambda^m(1-\lambda^m)N^m\right) \\ \times \dfrac{u(Y^L - R\widetilde{\eta} + \widetilde{T}, \widetilde{\eta}, 0)}{r}, & \text{if } \widetilde{\eta} < \widetilde{\eta}^l; \end{cases}$$

where the utility of a low-income homeowner of RTB house of quality within $(\widetilde{\eta}^l, \widetilde{\eta}^m)$ is:

$$r\widetilde{W}_{RTB} = u(Y^L - R\widetilde{\eta} + \widetilde{T}, \widetilde{\eta}, 1) - rFC\widetilde{\eta}.$$

B5. Proof of Proposition 5

The equilibrium housing rent of private houses, stated in Eq. (2), implies that the quality of private houses optimizes the utility of high-income tenants. Also, the optimal quality of council housing, $\eta^\star$, maximizes the low-income tenants' utility of renting the council houses, which solves Eq. (7). Thus, when the housing subsidies per low-income tenant, T, is no less than the difference between the high and low income, $Y^H - Y^L$, it is optimal for the local authorities to provide a low-income tenant with a rent subsidy that equals T in cash to rent a private house.

When $T < Y^H - Y^L$, the optimal quality of council housing that maximizes the low-income households' utility of renting the council houses, $\eta^\star$, is less than one (the normalized quality of private houses). Since $R^2u_{CC} - Ru_{CH} - Ru_{HC} + u_{HH} < 0$, we have $-Ru_C + u_H > 0$ for any quality level of council housing that is higher than the optimal one, $\eta^\star$. Then the utility of low-income tenants obtained from renting council houses of quality higher than the optimum is lower than $u(Y^L - R\eta^\star + T, \eta^\star, 0)$. Thus, after receiving the housing subsidy, T, a low-income tenant obtains higher utility from renting a council house of quality $\eta^\star$, where $\eta^\star < 1$, than renting a private house of quality one. That is:

$$u(Y^L - R + T, 1, 0) < u(Y^L - R\eta + T, \eta, 0).$$

Therefore, when the budget on housing is limited such that $T < Y^H - Y^L$, it is optimal for the local authorities to provide both a housing subsidy, T, and a rented council house of quality, $\eta^\star$, which is lower than private-housing quality, to a low-income tenant.

References

Aaron, H., Von Furstenberg, G., 1971. The inefficiency of transfers in kind: the case of housing assistance. Econ. Inq. 9 (2), 184–191.

Bruce, N., Waldman, M., 1991. Transfer in kind: why they can be efficient and non-paternalistic. Am. Econ. Rev. 81 (5), 1345–1351.

House of Commons, 1999. The Right to Buy. Research Paper 99/36. House of Commons Library: London. Available at http://www.parliament.uk/briefing-papers/RP99-36.

House of Commons, 2012. Reforming the Right to Buy. Standard Note SN06251. House of Commons Library: London. Available at http://www.parliament.uk/briefing-papers/SN06251.

Forrest, R., Murie, A., 1990. Moving the Housing Market: Council Estates, Social Change, and Privatization. Aldershot: Avebury.

Hughes, G., McCormick, B., 1981. Do council housing policies reduce migration between regions? Econ. J. 91 (364), 919–937.

Ioannides, Y., 1979. Temporal risks and the tenure decision in housing markets. Econ. Lett. 4, 293–297.

Jones, C., Murie, A., 1999. Reviewing the Right to Buy. Mimeo. University of Birmingham.

Jones, C., Murie, A., 2006. The Right to Buy: Analysis and Evaluation of a Housing Policy. Blackwell: Oxford.

Kiyotaki, N., Michaelides, A., Nikolov, K., 2011. Winners and losers in housing markets. J. Money Credit Banking 43 (2–3), 255–296.

Malpass, P., Murie, A., 1999. Housing policy and practice, (5th ed.) Basingstoke [England]; New York: Palgrave Macmillan.

Olsen, E.O., 2003. Housing programs for low-income households. In: Moffitt, R.A. (Ed.), Means-Tested Transfer Programs in the United States. Chicago: University of Chicago Press, pp. 365–442.

Ortalo-Magne, F., Rady, S., 2002. Tenure choice and the riskiness of non-housing consumption. J. Hous. Econ. 11 (September), 266–279.

Robst, J., Deitz, R., McGoldrick, M., 1999. Income variability, uncertainty and housing tenure choice. Reg. Sci. Urban Econ. 29 (March), 219–229.

Rosen, H., Rosen, K., Holtz-Eakin, D., 1984. Housing tenure, uncertainty, and taxation. Rev. Econ. Stat. 46, 405–416.

Schill, M.H., 1993. Distressed public housing: where do we go from here? Univ. Chicago Law Rev. 60 (2), 497–554.

Thurow, L., 1984. Cash versus in-kind transfers. Am. Econ. Rev. 64 (2), 190–195.